VOL. XII, PART IV *Published* 24 *November*, 1927

The British Mycological Society

(*Recognosce notum, ignotum inspice*)

TRANSACTIONS

Edited by

CARLETON REA and J. RAMSBOTTOM

Price to non-members, Seven Shillings and Sixpence net

CAMBRIDGE UNIVERSITY PRESS
LONDON: FETTER LANE, E.C. 4
ALSO
H. K. LEWIS AND CO., LTD., 136, GOWER STREET, LONDON, W.C. 1
WHELDON AND WESLEY, LTD., 2–4, ARTHUR STREET, NEW OXFORD STREET
LONDON, W.C. 2
CHICAGO: THE UNIVERSITY OF CHICAGO PRESS
(AGENT FOR THE UNITED STATES)
BOMBAY, CALCUTTA, MADRAS: MACMILLAN & CO., LTD.
TOKYO: THE MARUZEN-KABUSHIKI-KAISHA

PRINTED IN GREAT BRITAIN

LIST OF OFFICERS AND COUNCIL FOR 1927

Elected September 1925

President

G. H. PETHYBRIDGE, B.Sc., Ph.D.

Vice-President

E. J. BUTLER, C.I.E., D.Sc., F.R.S.

General Secretary

J. RAMSBOTTOM, O.B.E., M.A., Sec.L.S.
British Museum (Nat. Hist.), Cromwell Road, London, S.W. 7.

Secretary

Miss E. M. WAKEFIELD, M.A., F.L.S.
The Herbarium, Royal Botanic Gardens, Kew, Surrey.

Treasurer

A. A. PEARSON, F.L.S.
59, Southwark Street, London, S.E. 1.

Editors

CARLETON REA, B.C.L., M.A.
and
J. RAMSBOTTOM, O.B.E., M.A., F.L.S.

COUNCIL

The OFFICERS, with the following in addition:

Prof. Sir R. H. BIFFEN, F. T. BROOKS, Prof. A. H. R. BULLER, W. BUDDIN, A. D. COTTON, Prof. O. V. DARBISHIRE, F. G. GOULD, Miss G. LISTER, F. A. MASON, Very Rev. D. PAUL, R. PAULSON, T. PETCH, Prof. M. C. POTTER, Mrs E. A. REA, Miss A. LORRAIN SMITH, E. W. SWANTON, and H. WAGER.

SUB-COMMITTEE FOR PLANT PATHOLOGY

F. T. BROOKS, M.A. (*Chairman*)
W. BROWN, D.Sc.
E. J. BUTLER, C.I.E., D.Sc., F.R.S.
A. D. COTTON, F.L.S. (*Secretary*)
W. J. DOWSON.
T. PETCH, B.A., B.Sc.
E. S. SALMON, F.L.S.
M. WILSON, D.Sc., A.R.C.S.
The PRESIDENT and SECRETARY of the Society *ex Officio*.

RECENT LICHEN LITERATURE.

By A. Lorrain Smith, F.L.S.

INTRODUCTION.

THE scope of the present paper has been enlarged to include, as far as possible, all types of publications dealing with lichens. Both in the Handbook *Lichens** and in two subsequent papers issued in these *Transactions*, the systematic papers consisting mainly of lichen lists had been omitted. It is owing to special request that all publications dealing with lichen study, and omitted from my previous papers, dating back to 1920 or, in some few cases, to an earlier date, have now been inserted in the list of literature.

Several important books have appeared recently. One of the most notable, Tobler's *Biologie der Flechten*. After an introduction the subject matter, divided into chapters, deals with (1) Development and Growth, (2) Physiology, (3) Ecology and Adaptation, and (4) Symbiosis. Tobler is a convinced believer in the theory of symbiosis but he discusses and gives due prominence to the different views held by lichenologists; he also treats of the phylogeny of lichens and their reproduction processes. A bibliography giving notes on the works cited is a welcome feature of the book which is a very valuable addition to lichen literature.

Lichenologists of all nationalities are immeasurably indebted to Dr A. Zahlbruckner for his *Catalogus Lichenum Universalis*. He has already completed the third volume, and the fourth is in progress. Descriptions of genera and species are not supplied, but the authoritative systematy which includes a full account of nomenclature, along with habitat and localities of the plants, must give a great stimulus to systematic lichenology.

In addition to the above important work Zahlbruckner has issued a new edition of *Lichenes* (1926) in Engler-Prantl's *Pflanzenfamilien*. On the first page is recorded the lamented death of Dr M. Fünfstück who compiled the "Introduction." That portion of *Lichenes* had, however, been brought by him up to date as regards new works published since the printing of the first edition (1903–7). In the systematic portion Zahlbruckner has included much new material and some re-arrangement of families: the gelatinous lichens have now been inserted before the great groups of Lecideales and Lecanorales. The thanks of all lichen students are due to the renowned author for this masterly work.

* Cambridge University Press, 1921.

Another work of importance is Professor Migula's contribution on Lichens to the *Flora of Germany, Austria and Switzerland*, a work which was much needed for Central Europe. After a comprehensive introduction on general lichenology, there follows the systematic portion; and here we would enter a protest against the spelling of the genus *Teloschistes* thus named by Norman, but almost invariably as here, rendered as *Theloschistes*. The work is enriched by many coloured plates. Migula tends to the view that the relation of hyphae to gonidia in the thallus is a mild type of parasitism. The Flora is not yet completed.

There has also appeared a second edition of Part II of the Monograph of the British Lichens by myself. The new volume contains a number of necessary corrections, and additions. One genus has been added to the British list: *Clathroporina*, with a new species *C. calcarea* which was found and determined by Dr W. Watson. A number of species new to the British flora, some of them new to science, are included. Generous helpers in various districts have considerably widened our knowledge of lichen distribution in Great Britain and Ireland.

THE LICHEN PLANT.

Lichen Hyphae. Artificial cultures of lichen hyphae to illustrate lichen development have been carried out by Ch. Killian and R. G. Werner (1924). They found that spores of *Cladonia squamosa* germinated freely and in six weeks minute hyphal colonies had been formed. Sections of these were made, and a differentiation of tissue was already visible—a loose plectenchyma at the centre, with hyphal filaments at the periphery; a month later a small dome (about 1 mm.) was observed which in five months had increased to a height of 5·3 mm. The dome itself was unchanged in form, growth being intercalary in the basal region; but three tissues were then distinguishable—a medulla, a cortical tissue and between these two a region of loose hyphae in the position of the gonidial zone.

In a note published later (1925), Killian records results of the hyphal culture of *Xanthoria parietina*. There was a healthy growth and the body of hyphae was yellow. Killian draws the conclusion that lichen-fungi are able to develop without the alga. The production of the yellow colour can hardly be due to the presence of parietin as that is very closely associated with the presence of gonidia as proved by Tobler*. A more detailed account of *Xanthoria* culture is given by Werner (1926).

* See *Lichens*, p. 50.

The hyphae, developed from the spore, reached in ten months a size of 1·4 cm. in diameter, and 1 cm. in height. That is a rather abnormal development for *Xanthoria*, as the lichen lobes are in nature (when associated with gonidia) extremely thin as compared with their expansion. Werner noted the different tissue systems. A loose medulla, with rhizinose hyphae at the base, upwards a still looser tissue where the gonidia would normally be found and on the upper side a cortical layer with aerial filaments as described by Tobler* who also had found that the hyphae were brownish in colour.

Gonidia. An account of the distribution of the alga, *Trentepohlia*, by Paul van Oye (1923) has a direct bearing on the distribution of Graphidaceae in which family it is the almost constant gonidium. Both the alga and the lichen are abundant on trees in the tropics. Van Oye found that the alga grew in well-lighted positions, the presence of moisture being only of secondary importance, an observation that applies also to lichens which are mostly sun plants. The alga is protected from a too strong effect of insolation by the presence of haematochrome in the cells; it occurs at an elevation of 200 m. to 600 m above sea-level.

A curious account of the alga *Mycoidea parasitica* in Japan has been given by Molisch (1925). This alga is the gonidial symbiont of the lichen *Strigula* which is extremely abundant on leaves in India and other tropical lands. The alga itself is very common in Japan, but not the lichen. Whether this was due to the absence of the *Strigula* fungus or to the nature of the alga in Japan, Molisch could not decide.

The genus *Moriola* (Pyrenocarpaceae) was first described by Norman (*Bot. Not.* 1872, p. 113). The species grow on soil or bark and, so far, have been found only in Scandinavia. Recently Bachmann (1926) by careful study has cleared up much of the obscurity that has always surrounded the genus. In *Moriola pseudomyces* he found the main feature—the goniocysts—as had already been described, and compares them with the soredia of other lichens: they consist of a core of about a hundred algal cells of Cyanophyceae, possibly of more than one type. The hyphae are brown and occur at first in strands, then, as the goniocysts increase, the hyphae develop as permeating or as cortical tissues, the whole structure spreading until it is several times as broad as high. The mature cortex is composed of a layer of cells the outer walls of which are brown. The algae develop vigorously at first, then arises some parasitism of the hyphae on the algae, though Bachmann insists on the essentially symbiotic character of the association.

* See *Lichens*, p. 50.

The gonidium of our common lichens has been the subject of much study both as to its development and its systematic position. A paper by Puymaly (1924) in which is given a satisfying and conclusive account of this alga marks an important advance in exact knowledge. He has verified Treboux's description of it as a body with a large chromatophore and central pyrenoid; he finds, as did Paulson and Hastings*, that the contents round off into daughter-gonidia (aplanospores or autospores); he found this alga not only in lichens, but also as a free-living plant in the open, and as it differs from both *Cystococcus* and *Chlorococcum*, in which genera it has been classified, Puymaly has placed it in a new genus *Trebouxia*†.

M. and Madame Moreau (1925) concur in the conclusions of Puymaly. They have found the alga frequently on trees, and in many different lichens; but while asserting that the alga develops exactly as described, they figure a first transverse division before the contents round off into spores. This is a considerable variation from the direct formation of daughter gonidia as described by Treboux, Puymaly and Paulson, who found that no such division took place; nor did zoospores occur.

The gonidia of other types of lichens were also noted by the Moreaus; in *Solorina saccata* they found the alga was *Coccomyxa* as was previously determined by Chodat. In *Peltidea* they found *Stichoccoccus*—the minute form usually associated with hymenial gonidia (Zahlbruckner (1926) gives *Dactylococcus* as the alga of *Peltidea*). In all their work the writers detected no penetration of gonidia by the lichen hyphae, nor did they see the "pushing" hyphae described by Nienburg.

A careful description of hymenial gonidia in *Staurothele* adds to the value of Zschacke's work on Verrucariaceae (1924).

Morphology.

Aeration organs. An account of Norwegian species of *Nephroma* by Ove Høeg (1922) includes species with bright green gonidia (*Nephroma*) as well as with blue-green (*Nephromium*). He has paid special attention to the white spots or "pseudocyphellae" present on the lower cortex of *Nephromium resupinatum*. He found them chiefly in the neighbourhood of the apothecia which in this genus develop on the under surface. He considers them to be aeration organs but differing in origin from cyphellae or pseudocyphellae. They arise as papillae with a loose cortex and when that is broken off, there is left a hollow white spot resembling the cyphellae of *Sticta*. He finds thus three types of definite aeration organs: cyphellae as in *Sticta*

* *Lichens*, p. 56. † See also West and Fritsch, *British Fresh water Algae*, 1927.

sylvatica; pseudocyphellae in *Sticta crocata* and papillae in *Nephromium resupinatum.*

A description by Darbishire (1926) of the minute open pores on the under surface of the isidia of *Peltigera praetextata* adds further to our knowledge of lichen adaptations for securing gaseous exchange.

Du Rietz (1925) has described pseudocyphellae in *Parmelia Kernstockii*, yet another instance of the occurrence of aeration organs. Du Rietz refers also the white dots of *Parmelia cetrarioides* to pseudo-cyphellae.

Soredia. Du Rietz (1924) has gone somewhat deeply into the distribution and form of soredia and isidia. There is a tendency to excessive elaboration. He sets forth two types of soredia:

A. Diffuse soredia—when the whole or larger part of the thallus or cortex is dissolved into a continuous layer of soredia.

B. Limited soredia (soralia of Darbishire)—which are superficial or marginal. In this latter type he delimits soredia *punctiformia*, as in *Parmelia revoluta*, etc.; *maculiformia* as in *Pertusaria globulifera*; *rimiformia* as in *Parmelia sulcata*; and *maniciformia* (cuff soredia) which form a sorediate edge round any depression or hole. He also gives as a separate group those that form a border round the margin of the thallus.

In a recent study of soredia in *Peltigera erumpens* and *P. scutata* Darbishire (1927) has described the endogenous origin of these bodies. They arise owing to the activity of the meristematic tissue of the gonidial layer, but which element—gonidium or hypha—gives the stimulus to soredial formation, it is impossible as yet to say: there is undoubtedly close cooperation between the two symbionts; the hyphae push their way up through the cortex without causing any wound.

Darbishire raises anew the question of the connection—if any—between isidia and soredia and quotes Bitter in favour of his own view that they are distinct and separate products of the thallus; but in his account of *Parmelia farinacea* Bitter (*Hedwigia*, XL, p. 175, 1901) describes the isidia of the thallus as passing over to soredia, "die feinen isidiosen Sprossungen die sich endlich in Soredien umwandeln"; and again (p. 177), he notes, "*Parmelia farinacea* scheint mir ein gutes Beispiel dafür zu sein dass in manchen Fällen eine scharfe Grenze zwischen Isidien- und Soredien-produktion nicht besteht." Bitter holds, however, that in general they are distinct and specific. Rosendahl also in his work on the brown Parmeliae found sorediose isidia to be characteristic of *Parmelia verruculifera.*

Isidia. These are treated by Du Rietz (1924) in the same

detailed fashion as the soredia: they are divided into isidia *verruciformia* which occur as small outgrowths or warts; *cylindrica* as in *Pertusaria corallina*; *claviformia* as clavate hollow structures which may develop into squamules as in *Parmelia exasperatula*; *squamiformia* as in *Peltigera praetextata* and *coralliformia*—branching isidia as in *Umbilicaria pustulata*.

These divisions and subdivisions, both of soredia and isidia, though almost too detailed, do draw attention to the variety in lichen structures. Du Rietz considers both soredia and isidia in their different forms to be constant and specific, and not merely growth phenomena due to shade or excessive moisture. Parallel species, the one type bearing isidia or soredia, the other without these structures, are well recognised and have a definite distribution. The main function of soredia and isidia he considers to be that of propagation, though in isidia the extension of the gonidia-containing tissue adds to the amount of photosynthesis.

Darbishire (1926) deals with the isidia of *Peltigera praetextata*; but an account of the general development of the thallus is also given: marginal growth is provided for by the hyphae immediately below the gonidial zone—the meristematic tissue—which grow out horizontally and some of the cells form the tomentum by which the young margin is protected. The isidia are small outgrowths from the upper surface, usually the margin, of the mature thallus. They are formed from the gonidial hyphae which push up through the cortex; or isidia may arise where a crack in the thallus has taken place. The tissue layers are the same as those of the thallus; the under cortex is only one cell thick and is interrupted by occasional openings or pores of regular oval shape which evidently function as air-pores and are important for photosynthesis. These leaf-like isidia—the isidia *squamiformia* of Du Rietz—function rather as assimilative than as reproductive bodies; they enlarge considerably the photosynthetic surface. This view is reaffirmed in Darbishire's further paper (1927) but he seems to limit their function entirely to assimilation, whereas they are generally somewhat easily detached and are thus well fitted to reproduce the parent lichen.

Reproduction.

Not much work has been done on this difficult subject, but M. and Mme Moreau (1925) have contributed a study of apothecial development in *Parmelia acetabulum*, *Physcia* (*Xanthoria*) *parietina* and *Anaptychia ciliaris*, species which in the past have been favourite objects of similar research by workers such as Baur, Darbishire and others. It is with considerable interest that we turn to the results and conclusions arrived at which prove to be both new and unexpected. The most astonishing is

the discovery of clamp connections such as occur in the hyphae of Basidiomycetes, and not hitherto recorded for any Ascomycete. The writers claim that their occurrence establishes a relationship between the two great groups of fungi—Basidiomycetes and Ascomycetes—thus pointing to a common origin; but, accustomed as we are to the clearly defined clamps in Basidiomycetes, we find those ascomycetous "clamps" somewhat ill-formed and, as yet, not very convincing

Baur* had described a somewhat unusual development of the apothecial tissues in *Parmelia acetabulum*. The Moreaus find, as he did, that several carpogonia lying near the surface take part in the formation of the ascogonium; trichogynes are produced, but are evidently functionless. A wall of plectenchyma surrounds the young ascogonial tissue, which is formed of uninucleate hyphae rich in contents, and is traversed in an upward direction by sterile hyphae destined to become paraphyses. At a later stage, the ascogonial tissue is formed as a layer below the paraphyses and the hyphae are now binucleate. At this stage the clamp connections appear. This sequence of tissues is evidently the same as described by Baur though perhaps less clearly indicated. Finally the ascogenous hyphae penetrate the thalamium, a terminal septum cuts off the ascus, and details of further development follow.

In *Xanthoria parietina* they found that the ascogonial cells became plurinucleate, but the origin of this condition as also of the binucleate cells of *Parmelia acetabulum* was not traced. The authors base certain conclusions as to the origin of Ascomycetes on the varying types of ascogonial cells. Finally they draw attention to two subjects that require elucidation: (1) the origin and function of the trichogyne, and (2) the appearance of the binucleate cells.

In a discussion on reproduction, Zahlbruckner (1924) came to the conclusion that reproduction by sexual organs exists in the more primitive genera of Phycolichenes, but has died out in more highly developed forms such as *Peltigera*, and he adds that, probably, the same course of development occurs also in Archilichenes.

In the study of Norwegian Nephromae Ove Høeg (1922) made observations on the position of the pycnidia: they were marginal on the thallus of *Nephroma arcticum*, *N. laevigatum* and *N. resupinatum*, and on the under surface in *N. expallidum*; the latter species has a thin, rather weak cortex.

An interesting research on spore production in *Solorina crocata* has been successfully carried out by A. Hilitzer of Prague (1926). Spore discharge has often been seen and

* *Lichens*, p. 169.

described in Discomycetes: the phenomenon is more obscure in the long-lived apothecia of Discolichenes. The apothecium of *Solorina saccata* develops beneath the cortical layer of the thallus and the growth and expansion of the primordium push down the gonidial layer; at a more advanced stage a dense layer termed by Hilitzer as a lower cortical layer is formed below and provides a firm unyielding base to the hymenium. In time the emergence of the apothecium ruptures the overlying thallus, shreds of which remain on the outer margin of the disc. Some of the asci and spores reach maturity at the same time. Ejaculation results after wetting: a moist atmosphere is insufficient; rain or (in laboratory conditions) drops of water are essential to ensure spore discharge by thoroughly wetting the hymenial tissues. The pressure induced by the swelling of the paraphyses causes the rupture of the asci and the ejaculation of the spores. The specimens were kept in the laboratory, and statistics have been compiled by Hilitzer as to the number of asci and spores, and the continuation of spore production: in *Solorina* the apothecium retains fertility, *i.e.* the continued formation of asci and spores for two to four years.

Physiology.

Lichen Starch. There has been some discussion on the occurrence of starch in the lichen plant. That starch is produced by photosynthesis in gonidia as in other green plants is a well-known phenomenon, and can scarcely be regarded as a product of symbiosis. In a previous paper Mameli (1920) stated she had found starch grains not only inside the alga but also outside close to the gonidia. Tobler (1923) has taken up the question and found at certain periods (June to August and February to May) granules smaller than those described by Mameli on the outside of the gonidia—the lichens examined were from both shady and sunny situations. In lichens collected in October he found a greater abundance of starch within the green cells and the outside granules larger than those previously seen. He noted further that the granules became fewer and had almost disappeared during the darker months of the year. Fungal hyphae possess the capacity of absorbing carbohydrates and this record of the exchange of nutritive substances between alga and fungus gives an added support to the theory of symbiosis.

Lichenin. The problem of symbiosis has led to a research by R. and L. Chodat (1924) on the possibility of the gonidia being able to utilise the lichenin of the lichen hyphae. They experimented with gonidia from species of *Cladonia* which they grew on agar with or without an addition of glucose and lichenin.

Another series was tested on agar with saccharose and with maltose.

Lichenin added to any of the media had no effect on the cultures. Glucose was the most favourable to the growth of gonidia as well as to free algae: it alone doubled production. The authors gathered from these results that lichenin had not been available because the gonidia did not secrete the ferment that would have broken up and prepared the substance. It has been proved that when lichenin and maltose are hydrolysed by enzymes they form glucose, but evidently no glucose was formed in the cultures.

Isolichenin. From Giegenspeck (1924) we have a study of the blue reaction of the asci of lichens on the application of iodine, a reaction at one time considered to be one of the distinctions between lichens and fungi, though that has been long disproved. Czapek had concluded that the staining substance was some carbohydrate of the nature of galactose*, and Moreau gave to it the term amyloid. Giegenspeck has now found that isolichenin is present in the asci of *Xanthoria parietina*, *Cladonia coccifera* and *Ramalina fraxinea* along with small quantities of methylpentose and glucose. Isolichenin, usnein and evernin, he finds, have an affinity for moisture and must be of service in the absorption of water.

In the ascus, isolichenin was proved to be of value as a reserve material: he found it in larger or smaller quantities in the hymenium of *Cladonia furcata*, *Cetraria islandica*, *Usnea dasypoga* and *Xanthoria parietina*, and in great abundance in the soredia of *Lecanora tartarea*. In the asci of many fungi isolichenin is present, in others it is replaced by glycogen. In some lichens, *e.g. Baeomyces* sp., and *Graphis scripta* it was absent from the hymenium, but was present in the spore septa. The blue coloration when present fills the whole of the young asci but gradually disappears with the maturing of the spores. Though some lichens such as *Solorina* contain both isolichenin and glycogen, Giegenspeck found that where there was much of the one substance there was little or none of the other. An account of amyloid hyphae, *i.e.* lichen hyphae that give a blue reaction with iodine has been published by Bachmann (1926) who has suggested that the blue colouring substance of the outer hyphal walls may be identical with the isolichenin found by Giegenspeck in the asci. These hyphae occur in several species of *Lecidia* and also in *Rhizocarpon distinctum*: they are present in the cortex, gonidial zone and medulla, but the colour reaction is absent from the hyphae encircling the gonidia and from the outer and inner layers of the cortex. Bachmann

* See *Lichens*, p. 212.

considers that hyphae in these positions have been altered in chemical properties owing to special function. The yellow or brown cells that envelope the fruiting bodies are also without the blue reaction.

Colour Difference in Lichen Thalli. This subject was commented on by E. and F. Bachmann in their account of Litau lichens (1920). In full insolation many greyish lichens are often brown in tone: the brown swards were found in Rugen to be due to the presence of *Cetraria aculeata, C. stuppea* and *Cladonia furcata* f. *palamaea*; much the same lichens gave brown coloration on the Litau heaths while *Parmelia olivacea* formed brown patches on the erratic boulders. Colour differences in the same species are in no lichen so obvious as in *Xanthoria parietina* as indicated by the names given to the supposed varieties and forms of the species: *chlorina, albicans, virescens*, etc. The bright yellow colour so distinctive of the normal plant is due to the presence of the crystals of the lichen-acid, parietin, and the alteration of colour is caused by the varying amount of the acid deposited on the hyphae. Tobler (1925) has examined anatomically a large series of specimens to determine the origin and nature of the colour changes. He has concluded from his observation that the amount of parietin is conditioned by the amount of carbohydrate or starch provided by the symbiotic partner, the gonidium. One might rather consider parietin formation a symptom of all-round vitality. In favourable conditions of moisture and sunlight, he finds, gonidia are abundant and photosynthesis active, thereby resulting in a high production of starch. The hyphae also in such a favourable condition of nutrition form an excess of parietin as shown in the deep yellow colour of the thallus. Thalli growing in the sunlight as compared with those in the shade show a denser deposit of parietin, thicker cortex and more numerous densely packed gonidia and therefore more starch formation.

Räsänen (1927) found that nitrophilous—or as he prefers to call them ammoniophilous—lichens vary in colour according to the ammonia present on the substratum. If little is present *Xanthoria lychnea*, one of the most nitrophilous species, is red-yellow in colour (f. *aurcola*); if a large quantity, then the colour is greenish-yellow (f. *chlorina*). He allows that light and shade also affect colour.

A paper on lichen colour substances must be noted here though it dates back to 1917. In it Ryan and O'Riordan deal with the chemistry of the acids contained in the familiar lichens *Parmelia saxatilis* and *Ramalina scopulorum*. Much of the matter is concerned with methods of extraction (chiefly with acetone) and with the exact chemical formulae. Attention is

specially directed to the acid which gives the colour reaction, light yellow, then rust red; this they found in *Parmelia saxatilis*, and decided that it was salazinic acid. Zopf (1907) had pronounced the substance to be saxatilic acid, an isomer of salazinic acid, and gave the reasons for so regarding it.

Ryan and O'Riordan found that the scopuloric acid of *Ramalina scopulorum* showed also a close affinity to salazinic acid. From *Xanthoria parietina* they extracted physcione which on treatment yielded crystals, as yellow needles. When wool was boiled with this substance it acquired a dull orange-yellow colour, but with the addition of alumina as a mordant it was dyed a bright orange-yellow shade.

Migula (1924) in the preface to his *Lichen Flora* speaks of the action of lichen acids as not being confined to rock substrata; he suggests that it is by acids that the middle lamellae of the "host" cells are dissolved in corticolous species.

K. Goebel (1926) has suggested that lichen acids may prevent a too great absorption of water. In certain species the aerial hyphae are not easily moistened, but if the acids are removed by alcohol or ether, water is at once absorbed by the thallus.

Albo (1926) in a discussion of Sicilian lichens lays particular stress on the importance of oxalic acid to the plants. It is deposited in granules and crystals in the hyphae and lowers the concentration of nutritive solutions which according to him allows the inflow of new salts. It also lowers the freezing point of the lichen sap, thus enabling the lichen to exist in extreme cold.

Acidity or Alkalinity of the Substratum. Great attention has been given especially by ecologists to the *p*H values of soil, water, etc., as an influence in the growth of vegetation. Trümpener (1926) has attacked the problem of lichen distribution with regard to hydrogen ion concentration by testing the substratum—saxicolous or corticolous. He took a thin layer of the stone or bark, etc., soaked it for some hours in a definite amount of water and then tested it by the usual methods. He found on trees that the base of the trunk was more alkaline than the higher stem and branches and that ammoniophilous lichens congregated there. Might it be suggested that at the base there would be accumulated the washing down of bird's excreta which would account for the greater alkalinity? Ammonia he found was the source of the nitrogen required by lichens, and not nitrates or nitrites. He declares that the heat and dryness of town areas are as potent in banishing lichens as the presence of soot or gases in the atmosphere. This could not however apply to the large districts in the neighbourhood of our industrial towns—great moorlands

almost emptied of lichen vegetation. The subject of nitrophilous species is fully discussed.

Water Conduction. A preliminary paper on water absorption and storage as observed in Java lichens has been issued by K. Goebel (1926). Non-corticate lichens such as *Coenogonium* and *Dictyonema* spp. absorb water like a sponge. Those with projecting hyphal hairs or cilia also obtain water easily as these act as capillary agents. It is the smooth closely corticated forms that present the chief problem; but Goebel finds that the hyphae of these species with their swollen cell-walls readily imbibe water and that water travels from cell to cell. Chondroid tissues are, therefore, of use not only as strengthening tissues but also for water conduction. Gelatinous substances without structure as in *Collema* very readily imbibe water.

Bionomics.

An instructive paper by E. J. Fry (1926) gives further illustrations of the mechanical action of lichens on the substratum. On this occasion she deals with corticolous, crustaceous species. The hyphae penetrate the bark through cracks or other openings; in no case did she observe any penetration of the bark cells. Species of Graphideae and Lecanorae were examined and she found that under the thalline areolae, but especially under the reproductive bodies, there was an arched hollow formed, caused by the swelling of the gelatinous hyphae when moist. This dragging up of the periderm tended to loosen and disintegrate the host tissues. Experiments were made by planting apothecia on rubber and then moistening them: a hollow was at once formed under these bodies. It was observed that no arching took place under a loose powdery thallus: in such a case there was not enough thalline cohesion, no definite tissues being present. The author has thus proved that any disintegrating action of corticolous lichens on their substratum is mechanical and not chemical, being caused by the alternating expansion and contraction of the lichen tissues due to their absorption or loss of water.

A somewhat different explanation is given by Räsänen (1927, pp. 83–4). He considers that these corticolous species are not merely epiphytes: they are saprophytes (*corticis aprophyta*) as proved by the disintegrated and destroyed periderm cells. No one as yet has, however, found that the cells are entered by the lichen.

McWhorter had used the story of plant succession (lichens growing over mosses) as an argument to prove that lichens were parasites on the mosses. More recently Jennings (1923) has added more instances of the struggle as parasitic between the

two classes of plants; but we would point out that it is the mechanical smothering effect of the marauding plants that kills off the mosses: a very different conception to that of parasitism. One of the few cases of lichen parasitism is recorded by Malme from Brazil*.

Classification and Distribution.

Systematy. Critical discussions on this subject have not been lacking. Magnusson has followed up his Monograph of Scandinavian Acarosporae by discovering yet more new species of the genus (1924) from various European countries—one from Ireland, *A. opaca*, regarded previously as *A. fuscata*. He has also (1926) published critical notes on a number of other European lichens. His study (1925) on the *Rivulosa* group of the genus *Lecidea* goes into the question of affinities: the group was first defined by Th. Fries as having large apothecia, with pale hypothecium and small spores, the paraphyses being usually dark-brown at the tips. Magnusson adds other features, such as the well-marked hypothallus, and the absence of thalline reactions. All the species of the group grow on granitic rocks except a corticolous form of *L. rivulosa*.

Du Rietz (1924) has given us a number of careful papers on various lichens; special attention being devoted to Parmeliae. Among others he has made a study of *P. perlata*: he suggests discarding this name as of mixed import, his view being based on the lichens of Scandinavian herbaria. In Great Britain the species has always been well defined and understood. The first recorded and described specimen—*Lichenoides clausum perlatum* of Dillenius (*Hist. Musc.* 1741, p. 147, t. 20, Fig. 39 *A*, *B*, *D*, *E*)—was examined and confirmed by Nylander and Crombie (*Journ. Linn. Soc. Bot.* xvii, p. 567, 1880). It is one of our commonest British lichens, and in this country is not confused with any other. Crombie distinguished specimens with sparse black cilia on the edge of the thallus as var. *ciliata*. Du Rietz included Crombie's variety along with *P. proboscidea* Taylor, under *P. crinita* Ach. Acharius's species has the priority but it differs specifically from *P. perlatus* var. *ciliata*. Du Rietz further describes *P. trichotera* as "with lobes sparsely and shortly ciliate" evidently identical with Crombie's var. *ciliata*†.

Another change in nomenclature proposed by Wainio and accepted by continental lichenologists may also be noted here. It concerns the familiar British lichen *Parmelia caperata*—*Lichenoides caperatum*, etc. of Dillenius and *Lichen caperatus* L. An examination of the Linnean herbarium at Burlington House,

* See p. 253.

† A specimen kindly sent by A. Zahlbruckner confirms this view.

London, revealed that the only specimens of *Lichen caperatus* there belonged to *Cetraria pinastri*. The name *caperata* has therefore been given to the *Cetraria*, though Linnaeus based his account of *Lichen caperatus* on Dillenius's description and on his drawings as given in *Hist. Musc.* p. 193, Figs. 97 *A* = *P. caperata*, infertile; *B*, smaller state; *C*, fertile condition (*vide* Nylander and Crombie, *tom. cit.* p. 573). Surely such a clear account should weigh heavily against any importance being attached to specimens of mistaken identity and allow these two specific names to rank at least among *nomina conservanda*.

In yet another study (*Bot. Not.* 1924) Du Rietz discusses *Parmelia cetrata*—which name, we, following Wainio, had substituted for *P. perforata*, judged to be solely an American plant. Du Rietz has found from his study of herbaria that *P. cetrata* is also an American species and without soredia, and he revives for the European plant the name *Parmelia reticulata* Tayl., one of the later synonyms. All three species are distinguished by a delicate white reticulation on the upper surface of the thallus.

Hillman (1926) has also given attention to the systematy of Parmeliae in a discussion of *Parmelia incurva* and *P. centrifuga*. The latter dates from Linnaeus and has often been confused with *P. conspersa*. We have as yet no specimen from our own country. *P. incurva*, distinguished by yellow soredia, was originally published by Dickson (1793) as *Lichen multifidus*, by Persoon (1794) as *L. incurvus*. Dickson's name takes priority unless it is considered to be forestalled by *Lichen multifidus* Scop. (1772) which is a *Collema*, and could never have been confused. Dickson gives a good figure of his plant.

Hilitzer (1924) has contributed a critical account of Parmeliaceae in Bohemia. In the *Parmelia* family he includes three genera—*Candelaria*, *Parmeliopsis* and *Cetraria*; he has classified *Evernia furfuracea* as a species of *Parmelia*. Following the method of Nylander and Hue, Hilitzer has arranged his species in "stirps," thus indicating his view of relationships.

Oxner (1926) in his study of Siberian lichens from Lake Baikal records *Cladonia alpestris* f. *orientalis* f. nov. a form that, in his view, represents a geographical race which inhabits Siberia and is also found westwards towards the Urals. The form *sibirica* Mereschk. he finds is not purely Siberian; it is a mountain plant in Asia and also in Europe. *Cetraria odontella* and *C. Richardsonii* were found in fruit.

Magnusson has been working for some time on the northern species of *Stereocaulon* and has now (1926) published a Monograph of the genus in Scandinavia. He has established twenty-three species, with numerous varieties and forms. In the introduction he gives an account of the herbaria he examined and

of the collections made by himself, or which have been submitted to him by other workers. There follows a study of the anatomy of the vegetative structures, of the reproductive bodies and of the cephalodia. These latter bodies are of considerable taxonomic value as they differ in form, and in the type of blue-green algae present in their tissues. Systematy and distribution are also discussed. Many of the boreal species are circumpolar: they are also not infrequent on the higher grounds of more southern countries.

Bachmann (1926) gives a detailed anatomical study of a minute *Stereocaulon* considered by Nylander as an autonomous species and named by him *S. tirolense*. Arnold had referred the plant to *S. alpina* but Bachmann by his careful and exact research has vindicated Nylander's view. Magnusson has also taken that view. The lichen was known from a few localities in Tyrol, but has now been found by Magnusson in Hellbom's herbarium at Göteborg, collected in Finland on granite rocks and associated with *Parmelia sorediata* and several crustaceous lichens.

Du Rietz (1924) has published a valuable summing up of Scandinavian Alectoriae. He recognises ten species with varieties and forms, and these include practically all the European species.

The same author has prepared (1926) a synoptic arrangement of Scandinavian Ramalinae: they all belong to one section, *Bitectae*, distinguished by the chondroid elements in the medulla which form either separate strands or a definite ring within the cortex; the species are further arranged according to the presence or absence of soredia and the position of these on the thallus.

In the first instalment of a great work proposed by Du Rietz, a "*Synopsis Lichenum*," the genera *Alectoria, Oropogon* and *Cornicularia* are dealt with. The author in some cases has replaced diagnoses by helpful keys to the species. Each species has a more or less full synonymy with many instructive notes. Such a work along with Zahlbruckner's *Catalogus* will enrich Lichen literature and be of very great assistance to lichenologists. We may add that the genus *Cornicularia* includes species such as *Cetraria aculeata* and *Parmelia cornicularia* (*P. tristis*) which were not quite at home in these other genera.

Malme (1926) suggests changes in classification in his work on *Lichenes Blasteniospori* in Brazil (Regnell Herbarium). He places all the lichens with colourless polarilocular spores in one family—Teloschistaceae—under three genera *Callopisma, Xanthoria* and *Teloschistes*. He considers that the old generic name *Placodium* (Hill, 1751) accepted by Wainio and others (including the writer of this paper) is of too mixed import. *Callopisma*

takes precedence over *Caloplaca* and cannot be discarded, while *Blastenia* is redundant: thus the familiar *Placodium elegans* becomes *Callopisma elegans*! Might we not here again appeal to the rule of *nomina conservanda* for *Placodium* as a genus of *Blasteniospori*?

In an account of Chilian lichens (1925–26) Zahlbruckner records and discusses *Roccellina condensata* Darb. In his opinion *Roccellina* is not worthy of generic rank, and is only a section of *Dirina* differing in the somewhat placodioid thallus; a still more advanced thallus is found in *Combea*. Zahlbruckner traces a line of development from *Schismatomma* to *Dirina* and up to *Roccella*, and points out that the two genera *Reinkella* and *Ingaderia* with lirellate apothecia further confirm the relationship of Roccellaceae with Graphidaceae. He considers that in the Roccellaceae, genera, such as *Roccella*, with a fastigiate cortex are of an older type than those in which the cortex is formed of parallel hyphae.

Frey (1926) describes a Swiss lichen *Toniniopsis obscura* gen. et sp. nov. It is somewhat peculiar in thalline structure, being crustaceous but almost entirely plectenchymatous. Apothecia lecideine and spores 3-septate. The nearest affinity is with *Toninia*.

Extremely helpful systematic work on Verrucariaceae has been contributed by Zschacke (1914 and 1924) for Middle Europe. His descriptions are valuable (in *Staurothele* he carefully describes the hymenial gonidia), and there are full critical notes on systematy.

In 1922 Ove Høeg published a paper on Norwegian species of *Nephroma*, a genus distinguished from *Nephromium* by the bright green gonidia, and he has more recently (1924) published a systematic account with keys to the species of Norwegian corticolous Pertusariaceae and Thelotremaceae, the latter represented by one genus *Phlyctis*. In the full descriptions given large use is made of chemical reactions.

A new primitive family of tropical lichens, Cryptotheciaceae, has been described by myself*. The material was found in a collection of lichens belonging to the late Dr Stirton, a noted lichenologist in Glasgow, which had been sent to the British Museum, London, for examination. A series of specimens from India, Rangoon and Western Africa (Cameroons) had been received by Dr Stirton from various collectors about fifty years ago. They were all, to outward appearance, sterile crusts, but Stirton had examined them and had published as a result "*Cryptothecia subnidulans*," which he considered nearly akin to

* See *Transactions*, XI, pp. 189-96 (1926). Readers please note a mistake in the numbering of the plate figures.

Arthoniaceae. The thin crust of all the specimens is of the usual lichen structure, but deeply embedded below the gonidial layer are scattered "perithecia." Each perithecium is a solitary ascus with a peridium of loosely interwoven hyphae; the ascus contains one or up to eight spores. A number of specimens had been examined by Stirton and were labelled *Cryptothecia*.

There has been found material for two genera, *Cryptothecia* and *Stirtonia*, and six species, and their affinity in lichens has been judged to be with Mycoporaceae; in fungi with Myriangiales or Plectascineae. A specimen sent to me by Professor Van der Byl from Natal gives an additional locality for *Cryptothecia subnidulans*.

These notes on systematic work would be incomplete without the record of Keissler's careful studies on lichen parasites (1923, 1925): some of these are true lichens, others are fungi. An exact account of them and of their systematic affinities either among fungi or among lichens is very welcome.

Distribution.

Lichens of Temperate Lands. The study of lichens in the field as well as in herbarium and laboratory has not been neglected. Gonçalo Sampaio in two papers (1922, 1924) has greatly enlarged the record of lichens in Portugal, by adding species new to the country and by extending our knowledge of the distribution of familiar plants. He has continued the work begun by Coutinho (1910) who published a list of 298 lichens. Zschacke (1926) has compiled a list of lichens of the Davos Valleys in Switzerland. Bouly de Lesdain (1922 and 1923) has dealt with European forms, some new to science. Maheu and Gillet have added to Spanish lichenology, including Tangiers and the Canaries in their survey. In Italy Eva Mameli (now Signora Calvino) has listed 200 species or varieties for the Province Emilia, of which 128 are new to the province, while 30 are new to Italy. Zahlbruckner has published lists for Austria and for S. Africa (1926). These works and others are recorded in the Bibliography.

In our own country the enumeration of lichens collected during the forays of the British Mycological Society has been mostly undertaken by Knight (1922–5) and has opened up districts not previously examined. Watson (1925) has given in *Lichenological Notes* a new species, *Stenocybe bryophila*, and a genus new to Britain, *Clathroporina*, hitherto reported only from tropical countries. Most of the species are corticolous: the new one, *C. calcarea*, was found on limestone. It recalls the occurrence of *Anthracothecium*, also an exotic genus, in W. Ireland.

Watson (1925), in a paper on the Bryophytes and Lichens of Arctic-Alpine Vegetation, has compared the lichen flora of the Highlands of Scotland, the mountainous regions of Wales and of the English Lake District with those of other countries. He found that the species on the Grimsel Pass, Switzerland (7000–8000 ft.), were largely the same as those on the higher parts of Ben Lawers (3000–4000 ft.).

A list of lichens for the Ingleton District of Yorkshire has been compiled by Jones (1925). Rock lichens were better represented than those on trees, probably owing to the presence of smoke. Calcareous rocks were fairly rich in forms as were limestone walls. Boulders of millstone grit on the north-west side of Ingleborough were rather barren, those on the east side of the mountain were more productive.

A preliminary account of lichens in the Isle of Man by Hartley and Wheldon (1927) is in course of publication. The work had been well-nigh completed before the lamented death of J. A. Wheldon, a great naturalist and a delightful co-worker. Now it is being issued by Hartley. As the whole island is subject to sea-spray, the lichens might fairly be classified as all maritime or sub-maritime. This preliminary account deals mainly with the topography of the island and the conditions of temperature, exposure, etc., and interesting comparisons are made with the marine lichen-flora of Howth as worked out by M. C. Knowles, and with the coast flora of Lancashire. The Manx dunes are drier, more covered with pebbles and with less of shell-lime than the dunes of Lancashire: so the Cladoniae are more abundant as are crustaceous species on the pebbles. The island contains numerous hills but none of them are high enough to attract an alpine or mountain flora, though *Rhizocarpon geographicum* is found on the upland boulders; the hill species that do occur are mostly infrequent and not luxuriant.

An important paper has been hitherto unfortunately overlooked, in which Häyrén (1914) gave an account of the belts of vegetation on the sea-shore at Tvärminne. He had found, as did Frey in Switzerland, that the types of rock are important – flat rocks, boulders of various sizes, or rock faces. Temperature, insolation, wind and sea-water, however, affect the vegetation almost as much as geological and chemical conditions. Häyrén's observations coincided with those made by M. C. Knowles*, that the coast vegetation formed distinct zones or belts: Häyrén gives (1) sub-littoral, (2) lower littoral, (3) littoral, (4) upper littoral, (5) supra-littoral, and (6) supra-marine. Lichens such as *Verrucaria maura* appear in belt 5, supra-littoral; the higher belt (6) is sprinkled with *Placodium murorum*, above that with

* *Lichens*, p. 379.

Rhizocarpon geminatum, *Parmelia prolixa*, *Ramalina* spp. and further towards the land *Parmelia saxatilis*. Nitrophilous lichens, as so frequently noted, inhabit the rocks frequented by birds. Häyrén has listed 138 lichens from the sea-rocks of Tvärminne. The same maritime belts were noted by Hartley and Wheldon in the Isle of Man (1927).

Lichens of the shore also find a place in Du Rietz's study of vegetation in Gothland (1925). He notes two associations on the lime rocks of the sea-cliffs: (1) non-halophilous, and (2) halophilous. Composing the first were the lichens *Thyrea pulvinata*, *Collema multipartitum*, *Placynthium nigrum*, *Verrucaria nigrescens*, *Lecanora calcarea*, *L. atra* and others. The second halophilous association included more essentially maritime lichens, *Verrucaria maura*, *Lichina confinis*, etc.; these lichens, living under the influence of sea-water, developed on any kind of stone, and in the next higher zone *Caloplaca marina* was also fairly frequent on different kinds of rock; in the upper regions further removed from spray the influence of the substratum again became more marked. Du Rietz noted also that lichens on calcareous rocks were similar to those on bird-frequented siliceous rocks, and he suggests that the similarity may be due to the presence of lime in the excrement of sea-birds or in the natural alkalinity of the excreta. Wheldon and Wilson (1913)* noted in their account of Arran lichens the same indifference of lichens by the sea to the substratum.

Du Rietz has given also a clear account of the inland associations: on the ground, of lichens associated with phanerogams (grasses mostly) and, on rocks, pure associations of lichens, these being strongly influenced by the type of rock.

A study of mountain distribution in Central Europe is contributed by Los (1923) in his Brdage paper. He notes two distinct areas of elevation: the first from 200–400 m. in which there are few lichen plants; and a second from 450–636 m., a region of quartzite, with glacial remains. There he found *Rinodina oreina*, *Parmelia encausta*, *P. Mougeotii* and *P. stygia* with other Alpine species. On the western conglomerate mountain (650–657 m.) lichens were rare owing to the unfavourable substratum. Patches of grauwacke bore subalpine species and in the mountain streams he found *Bacidia inundata*, *Aspicilia lacustris*, *Verrucaria hydrela*, *Dermatocarpon fluviatile* and *Staurothele fissa*.

Du Rietz (1925) gives an account of the distribution of *Parmelia Kernstockii*: the species resembles *P. caperata*, but has pseudocyphellae and different soredia. It was first detected by Bernt Lynge and A. Zahlbruckner in the Tyrol, but an examina-

* *Lichens*, p. 379.

tion of herbarium material has supplied records from S. Austria, Asia (China), Africa (Kenya), and from California.

Hillmann (1923 and 1925) has done equally fine work for the Province of Brandenburg. In the first paper he tells us he drew largely on Egeling's records of lichens (1878 and 1883), and after him on the work of Otto Jaap (1902) and others. He has verified and published 353 species for the province. In his second paper (1925) he has brought the list up to 361 species and has widened the knowledge of distribution.

Meylan (1922) has contributed new records as well as new species for the Jura region. Osterwald (1923), in giving a series of localities for *Bacidia chlorococca* in Brandenburg, comments on the fact that in spite of its abundant growth on tree trunks it had only recently been discovered in the province: the thallus so strongly resembles a layer of green algae that close observation is required to distinguish the presence of the lichen. Erichsen (1923) published a record of lichens for Schleswig-Holstein with a careful account of habitats, localities and dates. It is interesting to find *Verrucaria maura* listed as the first record for Germany of that maritime species.

Josef Anders (1924) has followed up his study of conditions on the Isergebirg by an account of the lichen flora of the small turf-moors that occur amongst the woods of that region. The older branches of the conifers bear luxuriant plants of associated Cetrariae, Parmeliae, etc., while on the soil and on stumps there is another series mostly Cladoniae. The Buchberg, the highest basalt mountain in Middle Europe, was explored, but in general, the basalt was not exposed and the specimens collected were mainly corticolous. Anders (1926) gives also a sketch of lichens in the neighbourhood of Krimmel in Salzburg. The centre of the district was the Krimmel waterfall which supplied a moisture-laden atmosphere favourable to large foliose forms.

In a paper on lichens of Moravia, Suza (1925) presents a phyto-geographical study of the conditions in Central Europe. From one direction "holarctic" species have come down from the extreme north and are to be found on the high mountain chains: they are evidently glacial relics from the arctic tundra. A few xerophytic species from the Mediterranean have advanced inland from the south and south-east. He gives lists of lichens for the different localities and for the several substrata, organic and inorganic. Some xerothermic lichens are also recorded: *Cladonia foliacea* var. *convoluta*, *Solorinella asteriscus*, *Lecanora crassa*, *Thyrea pulvinata*, etc. His list for Moravia is 788 species belonging to thirty-four families.

In two other papers (1923, 1925) Suza gives results of various collections: in the first he records lichens from the Trencin

district, noting the absence of Parmeliae on calcareous soils and the scarcity of Cladoniae; in the latter paper, "Lichens des chênaies," he gives a list of epiphytic lichens found on oaks of great size and age that formed part of a virgin forest on the Teresva between Czecho-Slovakia and Roumania.

An exhaustive study of lichen distribution has been carried out by Räsänen (1927) for the lichens of North Finland which he has correlated with the topography and climate of the country. The different lichen substrata are examined in great detail: sea-rocks, loose stones in fields and in woods, as mountain rocks or in caves are passed in review. Stones in the open are, he finds, more densely covered with lichen vegetation than those in woods, and he adds that being more recently exposed than those in woods they have not yet been so much invaded by mosses. In caves he found lichens that naturally grow in shady situations; he notes in these the prevalence of red or yellow colours and compares that phenomenon with the red coloured algae that inhabit deep waters. Frey also (1921) gives the bright yellow *Acarospora chlorophana* as a cave-dweller. Nitrophilous lichens receive special attention: some seem to be absolutely dependent on a supply of ammonia, others tolerate its presence, while the large majority avoid it altogether.

Epiphytes were studied according to the tree and to the position on the tree; those on decorticated trunks and on wood he classes as "lignum" lichens and he publishes lists of the lichens found on the different woods and trees—pine, willow, etc. We have had no such detailed work since Arnold in 1891* gave us the lichens he found on each kind of tree.

In North America the lichens of the Lake George region have been enumerated by Burnham in a series of papers (1922). Merrill publishes (1924) a number of Cladoniae not only new to America but new to science; they were largely collected in the Southern States. Merrill also determined the lichens collected by Millspaugh and Nuttall in California. New Cladoniae from Massachusetts have been contributed by Robbins (1923 and 1924). From Western Pennsylvania a preliminary report was published by Giardini in 1922.

Polar Lichens. In Arctic regions records have been made of lichens in Spitzbergen and Bear Island. Summerhayes and Elton, in their accounts of the Oxford University Ecological Expedition (1923), included a considerable number of lichens (forty-two species determined by R. Paulson) in the various plant associations studied by them. Bernt Lynge has also devoted attention to the same regions which he proposes to visit himself. In his Spitzbergen paper (1924) he summarised the work of

* *Lichens*, p. 364.

several collectors in connection with Swedish and Norwegian expeditions. The lichens of Bear Island (1926) he has described in more detail, with added or revised diagnoses and various biological and geographical notes which should be of great service to students of Arctic lichens. He has enumerated 185 species, a large number for a comparatively small Arctic area. Lynge considers that plants in polar lands must either be such as are well adapted to the extreme conditions under which they live or be profoundly modified. Flowering plants have a better chance as they retire underground during the winter. Many lichens, however, though always exposed, are "adapted" and develop well, *e.g.* Caloplacaceae, Cetrariae and Gyrophorae. Others, especially crustaceous forms, are altered sometimes almost beyond recognition: species with normally well-developed thickish thalli are reduced to a few apothecia with some thin scattered areolae which frequently take on a warted or pyramidal form. The apothecia in structure, colour, spores and chemical reactions remain fairly constant and give the chief clue to specific determination.

Soredia and isidia are only poorly developed. Du Rietz had already noted this as well as the scarcity of apothecia in his paper on isidia and soredia, and concluded that dissemination, in Arctic climates at least, must be by means of broken portions of the thallus.

Magnusson (1926) has given us a study of the Acarosporae, brought from Novaya Zemlya in 1921 by the Norwegian Expedition. The species (ten in all) were in good condition.

Arctic lichens have been studied by Merrill (1924) in Northern Canada. Those from the Arctic coast were collected along the 70° parallel. A territory thirty miles inland from Alaska and another on the Coppermine River were also explored. The lichens were found on rocks by the shore, on pebbles, old bones, drift-wood and tundra formations, and a few on the dead branches of living trees. Crustaceous forms were most in evidence; they were well developed and fertile and entirely covered the rocks. Three species only were exclusively Arctic as far as N. America is concerned: *Cetraria chrysantha*, *Polyblastia scotinospora* and *Verrucaria striatula* f. *dealbata*. All the others occur also in mountainous regions further south. Merrill remarks that climatic conditions are unfavourable to rapid growth, and he judged that species in such climes might persist for a hundred years practically unchanged.

Lichens from Tropical or Subtropical Lands. Two small collections of lichens from the Far East have been examined by R. Paulson. His first report (1925) relates to the specimens brought from Mt Everest by Dr T. Howard Somervelle: they

were collected in the vicinity of the route followed by the explorers above the 14,000 ft. level; very few were found above 17,000 ft. Paulson gives a list of thirty-one, an addition of ten to the flora of the Alpine Himalayan system. A previous collection on these great heights had been made by Sir Joseph Hooker in 1849, and in both collections were found several species common to the Arctic lichen-flora. An endemic species, *Letharia flexuosa*, discovered by Hooker in Sikkim, was found on Mt Everest and it has also recently been reported by Professor J. W. Gregory from the Alps of Chinese Thibet. Paulson found the Mt Everest plants in healthy condition and the gonidia sporulating freely. Two new species are described.

The second paper (1926) gives an account of lichens from Sumatra and Timor in the Malay Archipelago. The most interesting is a new species, *Anzia Forbesiana*. Paulson has figured the strong rhizine which arises on the lower side of the medulla and pushes through and beyond the dense hypothallic cushion.

South America has always had considerable attention from lichenologists. Herzog (1922) has now given a list of the lichens collected by him in Bolivia. They were revised by Zahlbruckner and give a fair indication of the types of lichens prevalent in that country. Malme has issued three papers dealing with the collections of the Regnell Expedition. The first of these (1924) deals with the tropical families, Astrotheliaceae, Paratheliaceae and Trypetheliaceae. Two species, *Astrothelium punctulatum* and *Trypethelium annulare*, are notable and unusual in that they give rise to hypertrophy in the periderm of trees and may thus be considered as parasites giving rise to disease. The second paper (1925) is on Collemaceae. Malme finds that these blue-green lichens are equally abundant in warm temperate lands and in the tropics and that the same species occur over a wide area. Collemaceae grow frequently on soil but in the regions examined all soil lichens were rare, owing possibly to the very heavy rains. South American lichens have also received attention from Bernt Lynge (1924) who has collated species of *Parmelia*, *Candelaria*, *Teloschistes* and *Pyxine* contained in herbaria at Upsala, Stockholm and Berlin. In another paper (1924) he sums up what is known of South American Anaptychiae and Physciae, most of the data from Malme's collections in Brazil and La Plata. Questions of nomenclature and determination are discussed.

Malme (1926), in his paper on Brazil lichens dealing with the *Lichenes Blasteniospori** (1926), does not consider that these well-marked lichens are as widely distributed as, for instance, the blue-green forms. He rather questions the determination of

* See also under Systematy, p. 245.

specimens that would give support to such an estimate. Thus the Brazil varieties of *Teloschistes chrysophthalmus* are quite distinct from the European forms. On the other hand *Callopisma elegans* differs in no particular. He remarks on the probable great age of many lichen species: the similarity of lichens in Africa and in S. America may be due, he considers, to ancient geological conditions.

A. Zahlbruckner (1925–6) has contributed a paper on the lichens collected by Skottsberg in Chili while on the Juan Fernandez Expedition. They are from two provinces, Coquimbo and Santiago, in both of which the rocks are of volcanic origin. Most of the species are saxicolous, a fair number new to science. Zahlbruckner notes there, as elsewhere, the predominance of the genus *Buellia* on volcanic rocks. From the same author we have a paper (1926) on the lichens of Easter Island along with a description of three new species of *Buellia* in addition to those already described from Juan Fernandez.

Previously only three lichens had been recorded from Easter Island. Zahlbruckner records twenty-two species belonging to twelve different genera, several of them new to science. They grew mainly on volcanic rocks and, as elsewhere, Buelliae are partial to that substratum. Fruticose and foliose lichens were extremely rare, and only one blue-green species, *Heppia Guepini*, was collected.

In a posthumous paper by the lamented Lincoln Riddle, an account is given of some West Indian lichens from the Isle of Pines. One new genus was found, *Monoblastia*, belonging to the Pyrenulaceae, and distinguished by simple spores.

Lichens in the Philippines—their occurrence and distribution —have been discussed by A. W. Herre (1924) from his own observations in the Islands. He remarks that at first sight there would seem to be no place for lichens in the Manila region. "The ground for forty miles round the city has been under cultivation for many generations; only a few lichens appear on the palms or on old bamboos." Again in the forests only the trees along the edge get sun and air sufficient to induce much lichen growth, though the trunks of the trees, especially the younger ones, may be covered with Graphideae or with blotches of immature plants. If it were possible to reach the tops of the trees where there is light and air, a lichen flora would be found of great variety and richness. Vainio as we know has published (1921) quite a large lichen-flora for the Philippines. Malme (1924) in his account of Brazil Collemaceae had remarked on the greater abundance of *Leptogium* species on the trunks of trees on the outskirts of the woods though some grew well in the deep shade.

Lichen Succession. In the study of lichen distribution and also of ecology, the substratum has to be regarded as of the first importance, but room to extend is also necessary, many crustaceous and other species of unlimited growth requiring large areas for development. Hence arises a struggle for foothold and position, a phase of lichen study that is full of interest, and writers have recorded their observations on plant succession and dispossession from the days of Linnaeus onwards. One such sketch is given by Häyrén (1914) as to the vicissitudes of a *Parmelia saxatilis* association in its effort to establish itself: if the area had been already occupied by crustaceous or foliose species the *Parmelia* spread over them; *Parmelia conspersa* in young stages could alone withstand the invader, though occasionally the crustaceous *Lecanora atra* might spread over the older patches of *Parmelia saxatilis*. In this confused growth are entangled particles of soil and sand important in soil formation; finally *Parmelia saxatilis* becomes established as the dominant lichen.

Frey (1921) traced the colonising of zenith flats: first by species of *Rhizocarpon*, *Lecidea*, *Biatorella*, *Gyrophora*, *Lecanora* and the moss *Grimmia*. After a time the *Gyrophora* species ousted all the others, the *Gyrophoretum* association becoming so dense that all the crustaceous species were overwhelmed and ultimately destroyed. Again he noted that purely crustaceous forms meet and coalesce, but when species with a stouter squamulose thallus arrive, such as *Biatorella testudinea*, these spread over the others by means of their lobed edges. Forms still more efficiently lobed such as species of *Placodium* or *Physcia* are still more capable of dispossession.

Motyka, however, has judged (1926) that a space already occupied by crustaceous species is not easily invaded by *Gyrophora* as its spores will not germinate on organic material: the first colonisers persist, therefore, as members of the final association. True members, he holds, are the plants which are most suited to the prevailing conditions, which can spread over large areas and are not easily ousted.

Bernt Lynge (1924) has recapitulated the struggle for place as observed on a stone from Spitzbergen. The first coloniser had been *Rinodina milvina*, entirely crustaceous, which in time was overgrown by *Lecanora melanophthalma* of a stouter, more squamulose nature, by *Physcia caesia* and *Gyrophora arctica*. Finally the powerful Gyrophorae, with free lobes, had overshadowed and killed out all the other denizens of the stone. No other lichen was left except fragments of *Candelariella vitellina* which had settled wherever possible except on the thallus of the Gyrophorae.

ECOLOGY.

Colonisation. This aspect of lichen growth, so closely associated with "Lichen Succession," has received special attention from several workers. Frey (1922) in a note insists on the importance of lichens and mosses as pioneers of colonisation. On dry freely-exposed rock faces, lichens arrive very slowly, later follow mosses and phanerogams. On damp rocks the advance is more rapid: crustaceous species—Rhizocarpons and Aspicilias—settle first; foliose and fruticose forms follow and cover the rocks: a lichen-moss association at length becomes established. Frey (1921) is convinced from his own observation that the fungus in such lichens as *Rhizocarpon* develops first as a hypothallus: they are thus on a par with Graphideae where the fungus penetrates the bark and may persist without its symbiont alga for some time. In the case of the rocks he does not think that soredia are the agents of dispersal as there is no foothold for them. He argues further that as the breaking down of the thalline areolae is a pathological process these areolate particles are not in a condition to start new growths. This view is in opposition to the one generally held that the areolae are often set free by the action of external agents such as wind and rain, that they are in a perfectly healthy condition and often the chief agents of dissemination.

An interesting pioneer coloniser has been discovered by Kuppfer (1924)—the plant *Sterconema chthonoblastes* Kutz. It was first described as an alga, but is now recognised as a primitive lichen resembling the early stage of a crustaceous *Lecidea* or *Biatora*. The hyphae are associated symbiotically with several forms of green unicellular algae and as the resultant lichen covers large tracts of sand-flats it is of considerable importance in preparing the way for other plants. It has been reported from Danzig and from Riga and most probably occurs elsewhere.

Dissemination. Two important papers by Frey were unfortunately overlooked in my previous reviews of lichen literature. The first, already referred to, "Vegetative Relationships in the Grimsel region" (1921), dealt with lichens as part of a large survey of general vegetation. He strongly emphasised their pioneer work: given sufficient moisture they can populate the bare rocks; dry rocks remain barren; on rocks subject to dripping water Gyrophorae develop; where water trickles the rocks become more than half-covered with a variety of species, *Rhizocarpon geographicum* being the most abundant owing, Frey insists, to the capacity for long endurance of its hypothallic growth.

On the zenith flats which are usually rough—partly from glacier action—the rocks become covered with a series of crustaceous forms along with species of *Gyrophora* and with the moss, *Grimmia* sp. Finally there is formed a true *Gyrophoretum* as the crustaceous forms are crowded out by these larger foliose lichens. On the flat rocks where birds and marmosets congregate, the lichens of the above association at length disappear and are replaced by nitrophilous species: *Aspicilia cinerea* and *Lecanora saxicola* flourish.

On shaded rocks other types are found—*Pertusaria corallina*, *P. lactea*, etc. If, however, the shade gives place to lighter conditions—as when trees are cut down—other larger lichens predominate, such as *Parmelia saxatilis* and *Umbilicaria pustulata*. On damp slanting or overhanging flats *Gloeocapsa* algae form the first vegetation; they are succeeded by aquatic mosses and by the blue-green algae *Stigonema* and *Scytonema*; finally by an *Ephebe lanata* association, *Ephebe* having *Stigonema* as algal symbiont.

The various types of rock have been designated in his second paper (1923–24) as flat, vertical, sloping, overhanging, grotto faces and basal. It is on the top flats that nitrophilous lichens are most abundant.

Meylan (1926) also has emphasised the selective character of lichen vegetation in his examination of an erratic "bloc" in the Jura. The boulder, a mass of gneiss, rested on a calcareous base; both rocks had the same exposure. In all forty-seven lichens were found: twenty-four on the boulder, twenty-three on the support. Among all these only six species were common to the two types of substratum.

D. Alfred Hilitzer has recorded the results of recent work in Bohemia in a series of papers (1921–5). One of the more important deals with the lichens of the Labe Plain. It lies to the north of Prague and scattered over it are isolated dry sun-warmed rocks, either lydite or schist, rising to a height of 269 m. On the south and south-east smooth sides of the lydite he found a *Rinodina oreina* association, an extremely xerophilous group. On the summit of the rocks where birds rest, *Ramalina strepsilis* and other lichens form a nitrophilous association, while to the north and north-east occurs an *Aspicilia caesiocinerea* association. Three extremely xerophilous lichens, *Placodium rubinum*, *Rinodina oreina* and *Acarospora oxytona*, are present on the heated rocks of the plain as well as on the mountains above the high forests: in the driest as in the highest localities they find the atmosphere that suits them. Hilitzer concludes that humidity plays an all-important rôle in the ecology of lichens.

Lichen Associations. Chiefly Saxicolous. Frey (1923–24)

had suggested an improved terminology for lichen associations, adding the suffix "etum" to the dominant member. Thus in an alley of elms and limes, the trunks on the side exposed to wind and rain exhibited a *Parmelietum* composed of *Parmelia scortea*, *P. caperata* and *P. exasperatula* with, to a lesser extent Physicae and nitrophilous spp.—*Xanthoria parietina*, etc. Some or others of the same group occurred on all the trees.

In comparing conditions in the Grimsel with those of the Engadine, in the latter a drier locality, not only are shade lichens absent, but the foliose and fruticose species are smaller, more crowded, and of more compact growth.

From Motyka we have two important papers which form part of an ecological plant survey of the Tatra Mountains. It is a region of high pasture lands, but, here and there, lime dolomite and siliceous rocks or boulders provide a varied substratum. The persistent occurrence of certain definite associations of species is due not only to the chemical constituents of the rocks, but also, as in the Grimsel, to the supply of moisture and to the orientation and insolation or shade of the rock surfaces. Lichen "sociology" represents the response of the plants to these influences.

The first paper (1924) deals entirely with nitrophilous associations which are invariably to be found where birds or small mammals habitually rest and leave their excrements. Motyka describes three or possibly four such associations. They differ according to the abundance or scantiness of the nitrogenous material and also according to the nature and position of the rocks. It is pointed out that many of the strongly nitrophilous (rock) species (such as Xanthoriae) also occur on trees, and indeed, that certain genera are exclusively either corticolous or grow on nitrogenous substrata, also that genera with polari-bilocular spores provide many of these nitrophilous species.

The second paper (1926) on epilithic lichens gives an account of fourteen associations on siliceous rocks and three on calcicolous: the dependence of the lichen species on the substratum becomes very evident in a restricted territory such as the Tatra. The papers give interesting notes on the occurrence and succession of the different species, and on the different types that inhabit lime, dolomite or marl. One of the most frequent siliceous species is *Gyrophora cylindrica* which grows on all limeless rocks in exposed positions, avoiding only moist or shaded situations.

Chiefly Corticolous. Dr Hilitzer (1925) has published a study of epiphytic associations in Bohemia. He notes first the position or "ecology" of the associations and the factors that

are of influence such as substratum, atmosphere and the concurrence of species which he considers as primary factors; as secondary he distinguishes height, distance from the sea, exposition, soil and the special tree conditions. Again he envisages the species that are "eurychoric," that is, capable of living in widely diverse conditions, and those that are "stenochoric" as strictly limited to places or conditions and not therefore occurring in many associations. It is impossible to give any real account of so detailed a study: he follows the method of Du Rietz in counting the plants in uniform small areas or quadrats and gives the name of the dominant plant to the association. In an association, for instance, of *Lecanora subfusca* on *Fagus sylvatica* there are associated twenty-three other lichens and four mosses or hepatics. This association is confined to smooth bark, on the protected side of the tree and the dominant *L. subfusca* occupies more than the half of the area. An association of *Pertusaria amara* on similar types of bark gives twenty-nine associated lichens and five other cryptogams (mosses or hepatics).

In an association—*Pyrenula nitida*—with twenty-nine other plants (mostly lichens) the dominant *Pyrenula* immensely outnumbered all the others, a condition I noted as very striking when collecting near Dublin (1926).

After an account of thirty-three epiphytic associations in which twenty-three are dominantly lichenoid, two algal and eight of mosses or hepatics, Hilitzer (1926) devotes some pages to describing the position on the trunk, the associations differing according to height from the ground and to orientation.

Savicz (1923) has studied the forest formations in the pine woods of White Russia. On the trees there is a rather poor development of lichens: two associations, however, were evident, one on the branches with large pendant species, the other on branches and leaves consisting mainly of *Parmelia physodes*. Species that prefer a smooth bark grew on the upper reaches; on the lower trunks he found large lobed forms (*Peltigera, Lobaria*) which crowd out the mosses. Savicz stresses also the influence of the geological substratum.

Epiphyllous lichens are common in the tropics. In temperate lands only a few are confined to leaves. A number of species, however, frequently develop on leaves as well as branches. Frey (1923) has given an account of those he has noted in Europe such as *Parmelia physodes* on pines; *Candelaria concolor, Physcia tenella, Xanthoria parietina* and several others on *Buxus sempervirens*. Most of them spread from the branch to the leaves. Young thalli of *Physcia tenella* developed on the leaves from the soredial stage and were attached by the whole under surface

to the leaf without, however, piercing the leaf cuticle. In two years they had increased to a diameter of 1 cm.

A different and unusual substratum—decayed wood or wood in walls, roofs, etc.—was studied by Tomin (1918). He noted in three different species, two Ramalinae and one *Evernia*, that the plants in association were all short, crowded and with flattened fronds.

LIST OF PUBLISHED LITERATURE.

Albo, Giacomo. La Vita delle piante della Sicilia Meridionale-Orientale. Parte III, Licheni, pp. 1–87. Palermo, 1926.
General account of lichens and list of plants in S.E. Sicily.

Anders, Josef. Die Strauch- und Blattflechten Nordböhmens. II. Nachtrag. Hedwigia, LXI, pp. 351–74 (1920).
A descriptive account of the locality, and a list with habitat, etc. of some of the larger lichens—*Cladonia, Parmelia*, etc.

—— *Do.* III. Nachtrag. Op. cit. LXIII, pp. 269–322 (1922).
A continuation of previous work. Crustaceous lichens are described and also some of the larger forms.

—— Zur Flechtenflora des Isergebirges (Nachtrag). Hedwigia, LXV, pp. 65–84 (1924).
A supplement to a list published in 1923 (op. cit.). Several new varieties and forms of various species are described and one new, *Lecanora* (*Aspicilia*) *sanguinulenta*.

—— Zur Flechtenflora der Umgebung von Krimml in Salzburg. Hedwigia, LXVI, pp. 103–26 (1926).
In the centre of the district is the Krimmel Waterfall which supplies a moisture-laden atmosphere favourable to the growth of large foliose and fruticose forms.

Arkhimowitsch, A. Beiträge zur Flechtenflora der Ukraine und Krim. I. Parmeliaceen. II. Cladoniaceen. Bull. Acad. Soc. Oukraine, Kieff. Cl. sc. phys. I, II, pp. 44–8 and 55–9 (1924).
Paper not seen.

Bachmann, E. Die Goniocysten der Flechtengattung Moriola Norm. Ber. Deutsch. Bot. Gesell. XLIII, pp. 294–329, 6 figs. (1925).

—— *Stereocladium tirolinense* Nyl. eine selbständige Stereocaulonspezies. Hedwigia, LXVI, pp. 157–62, 8 text-figs. (1926).

—— Hyphae amyloideae bei einigen Flechten. Ber. Deutsch. Bot. Gesell. XLIV, pp. 201–7, 9 text-figs. (1926).

Bachmann, E., und Bachmann, Fr. Litauische Flechten. Hedwigia, LXI, pp. 308–42 (1920).

Bayer, Edwin. K. Lichenologickému výzkumu Cech. (Separate from the Věda přírodní. III. 11 pp. Prag (1922). See Hedwigia Beibl., LXIV, pp. 84–5 (1923), with German résumé.)
An examination of historical and current records of lichens in Bohemia.

Bouly de Lesdain. Lichenes prope Habanam in Insula Cuba Anno 1914 a Cl. Fratre Arsène Brouard lecti. Bryologist, XXIV, pp. 68–9 (1921).
A short list of species—two new to science—*Endopyrenium Brouardi* and *Tomasiella Brouardi*.

—— Quelques Lichens du Pas-de-Calais. Bull. Soc. Bot. France, LXVII, pp. 217–28 (1920).
A number of lichens and a few new forms are listed. Interesting biological notes are given. Unusual substrata such as iron, bones, leather, etc. are noted with the lichens found thereon.

Bouly de Lesdain. Lichens des environs de Versailles. Op. cit. LXVIII, pp. 16–24 (1921).

A supplement to lists already published: several new forms are included.

—— Notes lichénologiques. XVIII. Tom. cit. pp. 203–7 (1921).

The list includes the new genus and species *Henrica ramulosa*. New species are: *Alectoria funiformis*, N. America; *Lecanora Limica*, Portugal; *L. bracarensis*, Portugal; *Lecania Sampaiana*, Portugal; *Acarospora duriana*, Portugal; and *Microglaena Sampaiana*. Several of these are published in collaboration with Dr G. Sampaio.

—— Notes lichénologiques. XIX. Op. cit. LXIX, pp. 766–70 (1922).

Mainly descriptions of new forms and species from widely separated regions. The new species are: *Caloplaca italica* from Italy; *C. Meylani* from the Jura; *C. Mairei* from Greece; and *Lecanora subcenisia* from Cantal.

—— Notes lichénologiques. XX. Op. cit. LXX, pp. 277–83 (1923).

A list of lichens as above. New species are: *Parmelia Sharbaronis*, Liguria; *Lecidea italica*, Valtelline; *Opegrapha vetulinoides*, Italy; and *Verrucaria Sampaiana*, Portugal.

—— Notes lichénologiques. XXI. Tom. cit. pp. 842–9.

A list of lichens as above. A number of new varieties and forms have been described. The new species are: *Aspicilia Meylani*, Switzerland; *Toninia meridionalis* var.; *Buellia Duarte* Samp., Italy; and *Polyblastiopsis myrticola*, France.

—— Notes lichénologiques. XXII. Op. cit. sér. 5, I, pp. 787–91 (1925).

A number of new species are described, most of them from regions round the Mediterranean, S. France or N. Africa.

—— Lichens du Maroc recueillis par M. Mouret en 1912. Mém. Soc. Hist. Nat. du Maroc, N. VIII, pp. 290–9 (1926).

A considerable number of species listed. Those new to science are: *Heppia Maroccana, Caloplaca Mouretti, Lempholemma Mouretti, Acarospora Maroccana.*

Burnham, Stewart H. Lichens of the Lake George Region. Bryologist, XXV, pp. 1–8, 34–7, 58–9, 72–80 (1922).

The lists number 271 species.

Cengia-Sambo, M. Licheni di Rode raccolti dal Prof. A. Fiori nell' Agosto 1923. Bull. Soc. Bot. Ital. pp. 123–5 (1924).

Formerly only one lichen, *Ramalina calicaris*, had been recorded from Rodi: Cengia-Sambo has determined a new variety for that species, var. *sorediosa* and a number of other lichens.

—— Due Escursioni licheniche in Piemonte: Alta Valle della Dora Baltea e alta Valle d'Ala. Bull. Soc. Bot. Ital. pp. 181–7 (1925).

For the Val Dora Baltea 68 species are listed; for Val d'Ala 25. Several new forms were found.

Cheel, Edwin. Notes on a "Coral Lichen" (*Cladonia retepora*). The Australian Naturalist, I, 2, pp. 183–6 (1924).

A historical account of a beautiful plant and the localities in Australasia where it has been collected.

Chodat, R. and L. Les Gonidies des Lichens et la Lichénine. Compt. Rend. Soc. Phys. et Hist. Nat. Genève, XLI, pp. 74–6 (1924).

Choisy (Maurice Pautre). Collection de Micrographies Lichéniques. Lyon, 1927.

A collection of drawings and descriptions issued in loose sheets. Fascicles are to be issued annually.

Coutinho, Antonio Xavier Pereira. Lichenum Lusitanorum Herbarii. 122 pp. Manuel Lucas Torres, Lisboa, 1916.

An account of the study of lichens in Portugal with descriptions. Coutinho chronicles 298 species.

Crozals, A. de. Lichens de la butte volcanique de La Garde. Ann. Soc. Hist. Nat. Toulon, pp. 21–7 (1922). See Hedwigia, lxv, Beibl. p. 59 (1925).

—— Florule lichénique des Oliviers dans les environs de Toulon. Ann. Soc. Hist. Nat. Toulon, N. 9, pp. 45–75 (1923). See Bull. Soc. Bot. Fr. lxxi, p. 1250 (1924).
The author collected and determined 89 species and 16 varieties of lichens on the olive trees near Toulon.

—— Florule lichénique des environs de Vizzavona (Corse). Tom. cit. N. 9, pp. 76–115.
Crozals has enumerated 218 species, of which 100 are new to Corsica. Most of them were collected on the mountains.

—— Les Lichens du Massif des Maures. Op. cit. N. 10, pp. 88–116 (1924).

Danilov, A. Les hyphes des Lichens peuvent-elles reproduire les Algues, et la Chlorophylle peut-elle se former dans ses hyphes? Bull. Jard. Bot. Princip. Républ. Russe, xxi, Fasc. 3, p. 200 (1922). (Paper not seen.)

Darbishire, O. V. Some Aspects of Lichenology. Trans. Brit. Mycol. Soc. x, pp. 10–28, 1 fig. (1924).

—— Structure of *Peltigera* with especial reference to *P. praetextata*. Ann. Bot. xl, pp. 727–58, 4 pls. (1926).

—— Soredia of *Peltigera erumpens* Wain. and *P. scutata* Kbr. Trans. Brit. Mycol. Soc. xii, pp. 52–70, 2 pls. (1927).

Du Rietz, G. Einar. Lichenologiska Fragment. III. De Svenska Xanthoria-arterna. Svensk Bot. Tidsk. xv, pp. 181–91 (1921).
Du Rietz finds five species of *Xanthoria* in Sweden. Two of these distinguished by soredia: *X. candelaria* and *X. fallax*.

—— Lichenologiska Fragment. IV. Op. cit. xvi, pp. 69–76 (1922).
Three species of *Cladonia* are fully discussed: *Cl. Delessertii*, *Cl. symphicarpia* and *Cl. bacilliformis*.

—— Lichenologiska Fragment. V. Op. cit. xvii, pp. 83–95 (1922).
A varied series of lichens are discussed and described: *Alectoria cincinnata* is considered an autonomous species; the genus *Micarea* is retained.

—— Lichenologiska Fragment. VI. Op. cit. xviii, pp. 141–55 (1924).
A full account of Scandinavian (= European) species of *Alectoria*.

—— Morfologi och Systematik hos släket *Ramalina*. Särskillt dess skandinaviska arter. Op. cit. xx, pp. 295–8 (1926).

—— Den subantarktiska florans bipolära element i lichenologisk belsyning. Tom. cit. pp. 299–303 (1926).

—— Kritische Bemerkungen über die *Parmelia perlata*-Gruppe. Nyt Mag. f. Naturv. lxii, pp. 63–82 (1924).

—— Flechtensystematische Studien. IV. Botaniska Notiser, Lund, pp. 329–42 (1924).
Notes on *Leptogium rivulare*, *Parmelia cetrata*, etc.

—— Gotländische Vegetationsstudien. Svenska Säxtsociolog. Sallsk. Handl. ii, pp. 1–65, 16 figs. (1925).

—— Die europäischen Arten der *Gyrophora "anthracina"*-Gruppe. Ark. Bot. xix, N. 12, pp. 1–14 (1925).
Du Rietz has concluded that the name *Gyrophora anthracina* is of mixed import.

—— Einige von Dr M. Gusinde gesammelte Flechten aus Patagonien und dem Feuerlande. Op. cit. xx B, N. 1, pp. 1–6 (1926).
The species (nineteen in all) were collected in 1919–24. Du Rietz records a new species, *Pseudo-cyphellaria dubia*; and has contributed notes to several species.

Du Rietz, G. Einar. Vorarbeiten zu einer "Synopsis Lichenum." I. Die Gattungen *Alectoria, Oropogon* und *Cornicularia*. Tom. cit. N. 11, pp. 1–43, 2 maps, 2 pls. (1926).

—— Flechtensystematische Studien. V. Bot. Not. pp. 1–16 (1925).
An account of *Parmelia Kernstockii* from the Tyrol, also recorded from S. Austria, W. Africa and California (similar to *P. caperata* but with pseudocyphellae). Also an account of the *Cetraria lacunosa* group, of the distribution of *Roccella* spp. and a discussion of *Cladonia* sect. *Clathrina*. Du Rietz repeats the mistake of writing *Cl. retepora* as *retipora*.

—— Flechtensystematische Studien. VI. Tom. cit. pp. 362–72.
Studies of *Gyrophora rugifera, Sphaerophorus polycladus, Thysanophoron Pinkertonii* as *Sphaerophorus stereocauloides*, and *Ramalina Roesleri*.

—— Flechtensystematische Studien. VII. Op. cit. pp. 339–40 (1926).
A specimen, *Lobaria mollissima* Samp. from Portugal, has been recognised by Du Rietz as an *Erioderma*, a new genus for Europe.

Elenkin, A. Nouveaux travaux étrangers et russes, concernant ma théorie d'endosaprophitisme et la loi d'équilibre mobile des composants de la symbiose des lichens. Bull. Jard. Bot. Princ. Républ. Russe, xxi, fasc. 1, pp. 65–9 (1922). Russian.
A discussion of the papers published on endosaprophytism.

Erichsen, C. F. E. Neue Ergebnisse der Erforschung unserer Pflanzenwelt. Verh. Naturw. Ver. Hamburg, 1, 4, pp. 9–14 (1923).

—— Beiträge zur Lichenenflora von Teneriffa. Hedwigia, lxvi, pp. 275–82 (1926).
A short list of species: those new to science are *Ocellularia atlantica, Bacidia canariensis, Pertusaria Teguestensis, Rinodina agavicola* and *Buellia Lindingeri*.

Frey, Ed. Die Vegetationsverhältnisse der Grimselgegend im Gebiet der zukünftigen Stauseen. Mit. Naturf. Gesellsch. Bern, pp. 85–281, 11 pls., 5 text-figs., 1 map (1921).

—— Die Bedeutung der Flechten und Moose bei der Besiedlung von Silikatfels- und Silikatschuttböden. Ber. Schweiz. Bot. Gesellsch. Bern, xxxi, p. xxx (1922).

—— Epiphylle Flechten. Mitt. Naturf. Ges. Bern, pp. 1–2 (1923).

—— Die Berücksichtigung der Lichenen in der soziologischen Pflanzengeographie, speziell in den Alpen. Verh. Naturf. Ges. Basel, xxxv, pt 1, pp. 303–20 (1923–4).

—— Flechten. Fortschritte der Floristik. Ber. Schweiz. Bot. Ges. xxx, 5, pp. 73–5 (1926).
A new genus and species recorded in Switzerland: *Toniniopsis obscura* Frey.

Fry, E. Jennie. The Mechanical Action of Corticolous Lichens. Ann. Bot. xl, pp. 397–417, 35 text-figs. (1926).

Fünfstuck, M. Lichenes (Allgemeiner Teil). Engler und Prantl. Die Natürlichen Pflanzenfamilien, viii (zweite Auflage), pp. 1–60, 31 figs. (1926).
The author prepared the introduction of "Lichenes" before his death in Stuttgart, February 1925, in his 69th year.

Gams, H. Aus der Lebensgeschichte der Flechten. I–III. Mikrokosmos, xv (1921/22), pp. 187–90 (1922); xvi (1922/23), pp. 113–18 (1923); xvii (1923/24), pp. 148–54 (1924). See Ber. Schweizer Bot. Gesell. xxxiii, p. 1 (1924).
Paper not seen.

Gandara, Guillermo. Accion de los liquenes sobre otras plantas. Revista mexic. de briologia, 1, pp. 215–20 (1921). See Hedwigia, lxiv, Beiblatt, p. 37 (1923).
Paper not seen.

Gattéfosse, Jean. Le Commerce de la "Mousse de Chêne" dans l'Égypte ancienne. Le Monde des Plantes, sér. 3, xxiii, N. 23, p. 2 (1922). See Hedwigia, lxiv, Beiblatt, p. 116 (1923).

Genty, P. A. L'îlot granitique de Mâlain et sa végétation. Monographie phytostatique. Bull. Soc. Bot. France, lxxi, pp. 1069–84 (1924).

The territory is described as an island of granite rocks laid bare by some geological dislocation. The lichens collected (31) were characteristic siliceous species. *Buellia leptocline* was particularly abundant.

Giardini, Giovanni J. Preliminary Report on the Lichens of Western Pennsylvania. Bryologist, xxv, pp. 100–8 (1922).

Gibbs, L. S. Dutch N.W. New Guinea. A contribution to the Phyto-geography and Flora of the Arfak Mountains, etc. London: Taylor and Francis. 226 pp., 4 pls., 16 figs. (1917).

The paper deals almost entirely with the ecology of phanerogams, but on the summit of Koebré Mt., 9000 ft., the author found on an open plateau, where systematic burning took place, a remarkable association consisting of *Cladonia verticillata*, *C. didyma* and *C. coccifera* which covered the whole area as a uniform grey carpet, about 3 cm. high.

Goebel, K. Die Wasseraufnahme der Flechten. Ber. Deutsch. Bot. Ges. xliv, pp. 158–61 (1926).

Hansen, H. Mølholm. Lichenologiscke Notitser. Bot. Tidsskr. xxxvii, p. 460 (1922).

Cetraria islandica, *Parmeliopsis aleurites* and *Dermatocarpon Michelii* new to Veshjylland are reported.

Hartley, J. W., and J. A. Wheldon. The Lichens of the Isle of Man. A preliminary list showing the Distribution of the Species known to occur in the Island. Supplement to The North Western Naturalist, ii, pp. 1–12 (1927). To be continued.

Häyrén, E. Ueber die Landvegetation der Meeresfelsen von Tvärminne. Acta Soc. Faun. et Fl. Fenn. xxxix, pp. 1–193, 15 figs., 1 map (1914).

Henckel, A. Sur l'Hélotisme des Lichens. Bull. Inst. Recherches Biolog. Univ. de Perme (Russie) i, p. 1, pl. 1 (1923).

Paper not seen.

Herre, Albert W. Lichens in the Philippines. Bryologist, xxvii, pp. 85–6 (1924).

Herzog, Th. Beitrag zur Flechtenflora von Bolivia. Hedwigia, lxiii, pp. 263–8 (1922).

Lichens collected by the author and determined by A. Zahlbruckner. The writer presents the list as that of the most outstanding and important lichens of the S. American country.

Hilitzer, Alfred. Lišejníky drabovských křemenců nad Dobrichovicemi. Zvláštní Otisk Časopisu Musea, pp. 1–4 (1921). Czecho-Slovakian.

—— Systematika Parmelií ze skuping *P. olivacea*. Vestník (Prag, 1923), pp. 81–2, *fide* Hedwigia, lxv, Beibl. 59, p. 60 (1925).

Paper not seen.

—— Les Lichens des rochers amphiboliques aux environs de Všeruby. Zvláštní Otisk z Časopisu Národního Musea, 1923, 14 pp. (Prag, 1924). With French résumé.

—— Quelques Lichens intéressants des Krkonoše. Tom. cit. 5 pp. With French résumé.

—— Druhý příspěvek k lišejníkům drabovských křemenců. Op. cit. pp. 3–7 (1925). Czecho-Slovakian.

—— Enumeratio critica Parmeliacearum Bohemiae. Ann. Mycol. xxii, pp. 219–29 (1924).

The author lists with localities, etc. 41 species of *Parmelia* with other allied genera.

HILITZER, ALFRED. Addenda ad Lichenographiam Bohemiae. Acta Bot. Bohemica, III, pp. 3–15 (1924).

—— Étude sur la Végétation Épiphyte de la Bohème. Publ. de la Faculté Sci. Univ. Charles. 202 pp. Prag (1925).

—— Lišejníky křemitých skal v středním Polabí. Les Lichens des Rochers silicieux dans la Partie Centrale de la Plaine de Labe. Zvláštní Otisk z Preslie, III, pp. 10–22 (1923–5). Czecho-Slovakian with French résumé.

—— Notes sur la Production et l'Éjaculation des spores chez le *Solorina saccata*. Acta Bot. Bohem. IV, pp. 52–8, 3 figs. (1926).

—— Addenda ad Lichenographium Bohemiae, ser. 2. Acta Bot. Bohem. IV, pp. 42–51 (1926).
A large and interesting list of species in continuation of a previous lichen-flora. A few are recorded as new to Bohemia.

HILLMANN, JOHANNES. Uebersicht über die Arten der Flechten-Gattung *Xanthoria* (Th. Fr.) Arn. Hedwigia, LXIII, pp. 198–208 (1922).
Hillmann divides the genus into two sections, *Euxanthoria* and *Xanthosolenia*, the latter with one representative, *X. flammea*, distinguished by the apical almost immersed apothecia.

—— Uebersicht über die in der Provinz Brandenburg bisher beobachteten Flechten. Verhandl. Bot. Ver. Brandenb. LXV, pp. 36–75 (1923).

—— Zur Flechtenflora der Mark Brandenburg. I. Op. cit. LXVII, pp. 40–9 (1925).

—— Beiträge zur Systematik der Flechten. Ann. Mycol. XXIV, pp. 138–44 (1926).

HØEG, OVE. Die Norwegischen *Nephroma*-Arten. Nyt Mag. Naturvidensk. LX, pp. 85–97, 1 pl., 3 figs. (1922).

—— The corticolous Norwegian Pertusariaceae and Thelotremaceae. Nyt Magazin, LXI, pp. 139–78, 1 pl. (1924).
Full and careful descriptions of these families. He records one genus in Thelotremaceae, viz. *Phlyctis*.

HOWE, HEBER. A further Note on the Lichens of Nantuckett. Rhodora, XX, p. 40 (1918).

HULTING, J. Lavar från Östergötland. Arkiv för Botanik, XX, 2, pp. 1–80 (1926).
A record of the collectors since the days of Acharius. Thirty-three families of lichens are recorded.

HURST, CECIL P. Wiltshire Lichens in the Department of Botany at the British Museum. Wilts Archaeol. and Nat. Hist. Mag. XLII, pp. 427–50 (1924).

JENNINGS, O. E. Lichens crowd out Mosses. Bryologist, XXVI, p. 4 (1923).
A note giving additional record of the baneful influence of lichens on moss vegetation to the instances cited by McWhorter (Bot. Gaz. LXXII, pp. 321–5 (1921)).

JONES, D. A. Lichens of the Ingleton District. Naturalist, pp. 241–4 (1925).
A list of lichens collected during an Easter meeting of the Yorkshire Naturalists' Union. The effects of industrial smoke were noted.

KEISSLER, KARL. Einige interessante Flechtenparasiten aus dem Herbar Upsala. Ark. Bot. XVIII, N. 16, 24 pp. (1923).
Two new forms were found in the material from Upsala, and critical notes are given on a large number of species.

—— Systematische Untersuchungen über Flechtenparasiten und Lichenoide Pilze. III. Ann. Nat.-Hist. Museums Wien, XXXIX, pp. 162–8 (1925).
Keissler deals with 10 species belonging to different genera and growing on various lichens as parasites. Two of them, *Stagonospora Sandstedeana* on *Cladonia* sp. and *Libertiella Xanthoriae* are new to science.

KEISSLER, KARL. Systematische Untersuchungen, etc. Tom. cit. pp. 194–201.
Keissler reviews 10 different species. He has decided that *Hymenobolina parasitica* is not a Mycetozoon, but evidently his material has been faulty, as the whole development as a Mycetozoon has been carefully followed. He insists on the importance of the genus *Polyschistes* Steiner. Several species recorded under *Lecidea* have been transferred by him to fungi.

KILLIAN, CH., and R. G. WERNER. Cultures pures des Champignons de Lichens. Comptes Rendus Acad. Sci. CLXXIX. pp. 1339–42, 10 figs. (1924).

—— Nouvelles observations sur la culture de Cryptogames d'Alsace. Bull. Ass. Philomatique Alsace et Lorraine: Saverne, pp. 320–7 (1925).

KNIGHT, H. H. Lichens found during the Worcester Foray. Trans. Brit. Mycol. Soc. VII, p. 10 (1922).

—— Lichens of Haslemere District. Tom. cit. p. 225.

—— Lichens of the Windsor Foray. Op. cit. X, p. 9 (1924).

—— Lichens of the Matlock Foray. Op. cit. X, pp. 132–3 (1925).
The lichens were mostly crustaceous species.

—— Bettws-y-Coed Lichens. Tom. cit. pp. 242–4 (1926).
Parmelia, Lecanora, Lecidea and *Cladonia* are well represented in the list.

—— Lichens of the Tintern Foray. Op. cit. XI, pp. 9–10 (1926).

KUJALA, V. Untersuchungen über die Waldvegetation in Süd- und Mittelfinnland. I. Zur Kenntnis des ökologisch-biologischen Charakters der Pflanzenarten usw. C. Flechten.
Paper not seen (quoted by Räsänen).

KUPFFER, K. R. *Stereonema chthonoblastes*, eine lebende Urflechte. Korrespondenzbl. Naturf. Ver. Riga, LVIII, pp. 111–22, 1 pl. (1924). See also Hedwigia, LXVI, Beibl. pp. 8–9 (1926).

LETTAU, GUSTAVE. Die Flechten der Rheinhalde. Die Flora des Naturschutzreservates der Rheinhalde oberhalb Basel (A. Becherer, E. Steiger und G. Lettau). Verh. Naturf. Ges. Basel, XXXIII, pp. 131–4 (1922).

LINDAU, G. Lichenes novo-guineenses. Engl. Bot. Jahrb. LVIII, pp. 250–4 (1923).
The lichens of the collection Ledermann have been determined and listed.

LOS, V. K fytogeografii horských lišejníků brdských (Zur Phytogeographie der Gebirgsflechten des Brdagebirges). Sep. from "Časopis Národního Musea," Jhg. XCVII, 1, 7 pp. (1923). Prague. See also Hedwigia, LXV, Beiblatt, pp. 15–16 (1925).

LUND, MOGENS. *Cetraria cucullata* fundet i Danemark. Bot. Tidsskr. LX, pp. 460–1 (1922).
Cetraria cucullata new to Denmark.

LYNGE, BERNT. Lichens from the Gjøa Expedition. Vidensk. Skrift. I. Mat.-Naturv. Kl. N. 15, pp. 1–7 (1921).
The expedition to the N.W. Passage was under the command of Roald Amundsen. Most of the specimens were obtained at Gjøa harbour or at Herschel Island.

—— Lichens in the Herb. Gunnerus. Kgl. Norsk. Vidensk. Selsk. Skrift. 1920, N. 3, 12 pp. (1921).
A sketch of the work of Gunnerus, who died in 1773, and an examination of the lichens in his Flora Norwegica.

—— Lavslegten Parmelia i Danmark. Bot. Tidsskr. XXXVIII, pp. 69–78 (1923).
Lynge lists 22 species with localities, etc.

—— Lichens from Spitsbergen (Resultater av de Norske Statsunderstøttede Spitsbergenekspeditioner). Vidensk. I. Kristiania, 1, N. 5, 21 pp., 2 pls. (1924).

LYNGE, BERNT. South American Anaptychiae and Physciae. Vidensk. Skrift. I. Mat.-Naturv. Klasse, N. 16, pp. 1–47, 5 pls. (1924).

Keys are given to the genera. Most of the specimens were collected by Malme in Brazil and La Plata.

—— South American Lichens of the genera *Parmelia, Candelaria, Theloschistes* and *Pyxine*. Nyt Mag. Naturv. LXII, pp. 83–97 (1924).

Lynge has worked through the collections at Upsala, Stockholm and Berlin. New descriptions and critical notes are given.

—— Lichens from Bear Island (Bjørnøya) collected by Norwegian and Swedish Expeditions, chiefly by Th. M. Fries during the Swedish Polar Expedition of 1868. Resultater Norske Stats. Spitsb.-Eksped. I, N. 9, pp. 1–78, 1 map, 2 pls. (1926).

MAGNUSSON, A. H. New or Interesting Swedish Lichens. I. Bot. Not. pp. 401–16 (1923).

Notes on several new or rare species of crustaceous lichens. Magnusson goes into the question of synonymy as regards *Leptogium rivulare, L. Sernanderi* and *L. fluviatile*.

—— New or Interesting Swedish Lichens. II. Op. cit. pp. 377–91 (1924).

A list is given of somewhat rare species, with an account of several Parmeliae, notably *P. infumata*, also of *Baeomyces caprina* A. Magn. previously regarded as *Biatora* sp.

—— New Species of the genus *Acarospora*. Svensk Bot. Tidsk. XVIII, pp. 329–42 (1924).

Descriptions of numerous new species; a number are from Switzerland, but there are also species from France and Portugal and one from Ireland, *A. opaca* Magn.

—— Studies in the *rivulosa*-group of the genus *Lecidia*. Göteb. Kungl. Vetensk. Handl. XIX, N. 4, pp. 50 (1925).

—— Smärre Meddelanden. Svensk Bot. Tidsk. XIX, pp. 111–14 (1925).

Notes on species of rare occurrence in Sweden: *Cetraria normerica, Cladonia caespiticia, Cl. incrassata, Sticta limbata*, etc.

—— Studies on Boreal Stereocaula. Göteb. Kungl. Vetensk.- och Vitterh.-Samh. Handl. XXX, N. 7, pp. 1–89 (1926).

—— New or Interesting Swedish Lichens. III. Bot. Not. pp. 227–37 (1926).

Species new to science or new to Sweden are described. Several additions are made to the genus *Acarospora* and additional localities for some of the species described previously.

—— New or misunderstood European Lichens. Meddel. Göteborgs Botaniska Trädgård, II, pp. 71–82 (1926).

New species are *Lecanora atlantica* (nearly related to *L. intercincta*), *Acarospora Muddii* and *A. pyrenopsoides*; species criticised are *A. versicolor* Bagl. & Car. and *A. umbilicata* Bagl.

—— *Acarospora*. Report of the Scientific Results of the Norwegian Expedition to Novaya Zemlya 1921, N. 34, 7 pp. Oslo, 1926.

Magnusson describes two new species and one variety of *Acarospora*. There is a record of 10 Acarosporae; two new to science: *A. interposita* and *A. Novae Zemliae*.

—— New or Interesting Swedish Lichens. IV. Bot. Not. pp. 115–27 (1927).

Two new species, *Ochrolechia Bahusiensis* and *Lecanora rimicola*, the latter a small lichen of the *Hageni* group.

MAHEU, J., et GILLET, A. Contribution à la connaissance de la Lichénologie espagnole. Bol. R. Soc. esp. Hist. Nat. XXII, pp. 349–57 (1922).

The writers include Spain, Tangiers and the Canaries in their survey. They have listed 48 species.

MALME, GUST. O. A. U. Die Flechten der ersten Regnellschen Expedition. Arkiv för Botanik, XIX, 1, 34 pp. (1924).

A second paper which deals with the pyrenocarpous families Astrotheliaceae, Paratheliaceae and Trypetheliaceae.

Malme, Gust. O. A. U. Die Collematazeen des Regnellschen Herbars. Tom. cit. N. 8, 28 pp.
Malme deals with 5 species of *Collema* and 23 species of *Leptogium*.

—— En my fyndort i Västergötland för *Cetraria normerica* (Gunn.) Lynge. Svensk Bot. Tidsk. xviii, pp. 548–9 (1924).
Notes on the occurrence of *Cetraria normerica* (*Parmelia corniculata* (Lightf.) A. L. Sm.).

—— Lichenologiska Notiser. Tom. cit. pp. 312–17 (1924).
Notes on the occurrence and distribution or biology of several species.

—— Die im Regnellschen Herbar aufbewahrten Arten der Flechtengattung *Lecanactis* (Eschw.) Wainio. Ark. Bot. xx, 2, pp. 1–6 (1926).
Three species of *Lecanactis* are recorded and described by Malme.

—— Die Pannariazeen des Regnellschen Herbars. Tom. cit. N. 3, pp. 1–23 (1926).
Five genera of Pannariaceae are included: *Parmeliella, Pannaria, Psoroma, Coccocarpia* and *Erioderma*. A number of new species are described in *Pannaria* and *Psoroma*.

—— Lichenes blasteniospori Herbarii Regnelliani. Tom. cit. N. 9, pp. 1–51 (1926).

Malta, N. Die Kryptogamenflora der Sandsteinfelsen in Lettland. Acta Horti Bot. Univ. Latviensis, 1, N. 1, pp. 13–31 (1926). German résumé, pp. 31–2.

Mameli, Eva. Contributo alla Lichenologia del Forlivese. Atti Istit. Bot. R. Univ. Pavia e Laborat. Crittog. Ital. ser. 3, 1, pp. 13–34 (1924).

Mathiesen, Fr. J. Lichenologiske Notitser. Bot. Tidssk. xxxvii, pp. 459–60 (1922).
New records for Denmark.

—— Lichens. A botanical trip to Jan Meyen by Johannes Gandrup. Dansk. Bot. Ark. iv, pp. 24–28 (1924).
Earlier collections have been described by several lichenologists. There are, however, a number of new records. They are all more or less boreal in character. Lichens and mosses formed the principal vegetation of the Island.

Mereschokovsky, Const. Le *Parmelia camtschadalis* existe-t-il? Note dédiée à V. P. Savicz. Hedwigia, lxi, pp. 303–7 (1920).
The writer insists on the occurrence of this lichen in Kamtschatka. Savicz after an exhaustive search in Kamtschatka had arrived at the conclusion that there had been some interchange of labels between species; that it did not grow in that country.

—— Notes sur les Lichens de Revel. Bull. Soc. Bot. France, lxvii, pp. xiv–xvi (1920).
Discussion of *Ramalina fraxinea* f. *taeniata* Syd. and of *Lecanora perplexa*, recorded among the lichens of Revel.

Merrill, G. K. New Species of American Cladoniae. Bryologist, xxvii, pp. 21–6 (1924).
Most of the new species were contributed by S. Napp from Sanford, Florida.

—— Report Canadian Arctic Expedition 1913–18, vol. iv. Botany, Part D Lichens. Ottawa, 1924, pp. 3–12.

Meylan, Ch. Contribution à la Connaissance des Lichens du Jura. Bull. Soc. Vaud. Sci. Nat. liv, pp. 287–94 (1922).
New localities and species for the Jura and for Switzerland.

—— Nouvelle Contribution à la Connaissance des Lichens du Jura, avec quelques Indications de Localités des Alpes. Op. cit. lvi, pp. 173–8 (1926).

—— La Flore bryologique et lichénologique du bloc erratique de la Grange-de-la-Côte. Tom. cit. pp. 165–72, 2 text-figs.

Migula, Walter. Flora von Deutschland, Österreich und der Schweiz. Abt. II. Kryptogamenflora, XII, Die Flechten, Lief. 1, pp. 1– (1924).
The issue has reached to date, Feb. 1927, Lief. 20 up to p. 512 and to Family Acarosporaceae. Zahlbruckner's arrangement of families in the Pflanzenfamilien is followed. The work is enriched by plates, many of them coloured and beautifully reproduced.

Millspaugh, C. F., and L. W. Nuttall. Flora of Santa Catalina Island (California). Lichenes. Field Mus. Nat. Hist. Bot. v, pp. 358–77 (1923).
The lichens were determined by Merrill. There is a wide range of genera as well as of species represented, many of them European.

Molisch, Hans. *Mycoidea parasitica*. Sci. Reports Tóhoku Imp. Univ. Sendai, Japan, XII, pp. 111–15, 1 pl. (1925).

Molliard, M. Lichens décorateurs d'églises. Bull. Soc. Bot. France, LXX, pp. 236–7 (1923).
Molliard in his note indicates the type of lichen most abundant on old churches in Caux. Mostly these were *Lecanora* (*Placodium*) *lobulata* and *L. atra*.

Moreau, M., and Mme Fernand. Les Différentes Formes de la Symbiose lichénique chez le *Solorina saccata* Ach. et le *Solorina crocea* Ach. Rev. Gén. Bot. XXXIII, pp. 81–7 (1921).

—— Recherches sur quelques Lichens des Genres *Parmelia*, *Physcia* et *Anaptychia*. Rev. Gén. de Botanique, XXXVII, pp. 385–417, 12 figs. (1925).

Motyka, Jozef. Zespoty roślin w Tatrach. Część II: Naskalne zespoty porostów nitrofilnych w polskiej części Tatr Zachodnich. Die Pflanzenassoziationen des Tatragebirges, II Teil: Die epilithischen Assoziationen der nitrophilen Flechten in Polnischen Teile der Westtatra. Bull. Acad. Pol. Sci. et Lettres, Cl. Sci. Math. et Nat. 1924, pp. 836–50, 1 pl.

—— Część VI. Studja nad zespolami Naskalnych porostów. Die Pflanzenassoziationen des Tatragebirges. VI Teil: Studien ueber epilithischen Flechtengesellschaften. Op. cit. pp. 189–227 (1926).

Moxley, George L. Some Vacation Lichens. Bryologist, XXIV, pp. 24–5 (1921).
List of species from the Topanga region, California.

Nilsson, Gunnar. *Arthonia spadicea* Leight. funnen in Göteborg. Svensk Bot. Tidskr. XVII, p. 530 (1923).
Note on the above Lichen found recently at Gothenburg.

Osterwald, Karl. Ueber die Verbreitung der Krustenflechte *Bacidia chlorococca* in dem Florengebiet von Berlin. Verh. Bot. Ver. Prov. Brandenburg, LXV, pp. 75–8 (1923).
A species overlooked and then found to be abundant in many localities.

Oxner, A. N. Beiträge zur Flechtenflora Weissrusslands. Bull. Jard. Bot. Kieff, I, pp. 27–36 (1924). German résumé.
The author describes soil associations of lichens. One new form is described, *Parmelia perlata* f. *sorediifera*. The species were collected in Minsk and Igumen.

—— Neue und bis jetzt in der Ukraine wenig bekannte Flechten-Arten. Op. cit. II, pp. 20–8 (1925).
A list of 11 species, 10 of which are new to the Ukraine.

—— Neuheiten der Flechtenflora der Ukraine. Op. cit. III, pp. 8–21 (1925). Russian with German résumé.
The author lists 21 novelties for the Ukraine. A number of species usually sterile were found in fruit. The geographical range of several species has been extended.

—— Zur Flechtenflora Weissrusslands. Tom. cit. pp. 33–4.
The author gives a list of 8 lichens new to White Russia.

Oxner, A. N. Les Lichens du Transbaical, collectés en 1916 par G. G. Kanewskij. Ucrainian Botanical Review, III, pp. 1–10 (1926). Russian with French résumé.

The lichens were collected in 1916 on the further side of Lake Baikal. A new *Cladonia* in the group Uncialis, *Cl. Kanewskii* Oxner, has been described.

Oye, Paul van. Zur Biologie von *Trentepohlia* auf Java. Hedwigia, LXIV, pp. 175–89 (1923).

Paulson, Robert. Lichenes in Forbes' New Guinea Plants. Journ. Bot. LXI, Suppl. p. 64 (1923).

—— Some common Lichens. School Nature Study, XIX, pp. 54–8, with illustrations (1924).

An introduction to the study of lichens, with an account of some common species.

—— Lichenes. Shackleton-Rowett, "Quest" Expedition. Journ. Bot. LXIII, p. 70 (1925).

A list of six species: one from Gough Island, the others from Nightingale Island (Tristan da Cunha group); the latter grew on the short branches of a small shrub.

—— Lichens of Mount Everest. Tom. cit. pp. 189–93.

—— Dr H. O. Forbes' Malayan Plants. Lichenes. Op. cit. pp. 139–42 (1926).

Polyanskij, Vladimir. De Xanthoriis in opp. Pavlovsk collectis notula. Not. Syst. Inst. Crypt. Horti Bot. Petrop. II, pp. 184–9 (1923).

Paper not seen.

Puymaly, A. de. Le *Chlorococcum humicola* (Naeg.) Rabenh. Revue Algologique, I, 2, pp. 107–14 (1924).

Ramsbottom, J. Special Groups of Plants. B. Lichens, pp. 23–36.

Aims and Methods in the Study of Vegetation. A. G. Tansley and F. T. Chipp. Cambridge University Press, 1926.

A general account of lichens in relation (ecologically) to other groups of plants. The importance of lichens as soil-makers is emphasised.

Räsänen, Veli. Einige neue und bemerkenswerte Flechtenfunde in Finnland. Medd. Soc. Faun. et Fl. Fenn. 1919–20, pp. 156–74 (1921).

Noteworthy lichens from different districts of Finnland. A few species and varieties or forms are new to science. The new species are *Usnea prostrata* Wain., *Placodium leucoleprosum* Wain., *Physcia Wainioi* Räs., *Mycoglaena acuminans* Wain. and *Didymocyrtis consimilis*, the latter parasitic on *Placodium gilvum* and evidently an Ascomycete.

—— Die Flechtenflora des Gebiets Ostrobottnia Borealis. Suomalaisen Eläin-ja Kasitieteellisen Seuran Vanamon Julkaisuja III, N. 8, pp. 268–349 (1926).

A catalogue of species from N.E. Bothnia. Several new species are included.

—— Ueber Flechtenstandorte und Flechtenvegetationen im Westlichen Nordfinnland. Suomal, Kirjall, etc. Helsinki, pp. 190 (1927).

Riddle, Lincoln W. The Lichens of the Isle of Pines. Mycologia, XV, pp. 68–88 (1923).

Interesting to students of tropical lichens as many of them are rock species. Riddle has described one new genus, *Monoblastia* (Pyrenulaceae), and 14 new species, 11 of which grow on rocks. Most of the lichens previously known from the W. Indies are corticolous.

Robbins, C. A. *Cladonia Beaumontii* in Massachusetts. Rhodora, XXV, pp. 46–7 (1923).

—— Some new Cladonias. Op. cit. XXVI, pp. 145–8 (1924).

The plants were collected at Wareham, Massachusetts, and were finally submitted to Wainio whose descriptions and notes are given. There is one new species, *C. clavulifera* Wain.

ROSENVINGE, L. KOLDERUP. Lichenologiske Notitser. Bot. Tidsskr. XXXVII, p. 461 (1922).
New records of *Umbilicariae*.

RYAN, HUGH, and W. M. O'RIORDAN. On the Tinctorial Constituents of some Lichens which are used as Dyes in Ireland. Proc. Roy. Irish Acad. XXXIII, Sect. B, pp. 91–104 (1917).

SAMPAIO, G. Novas contribuições para o estudo dos Liquenes portugueses. Broteria, XIX, pp. 12–35 (1921).
Seventy-four species are listed, two new to science: *Acarospora Zahlbruckneri* and *Lecanora lisbonensis*.

—— Materiais para a Liquenologia portuguesa. Op. cit. XX, fasc. 3, pp. 147–63 (1922).

—— Novas Materiais Liquenologia portuguesa. Bol. Soc. Brot. II (2 sér.), pp. 161–79 (1924).
In both papers, the lichens of Portugal are dealt with, 60 in one paper, 56 in the other. A considerable number are new to science, too numerous to list here.

—— *Carlosia*, a new Genus of Cypheliaceae. Nota appresentado ao Congresso de Salamanca.
The new genus is allied to *Cyphelia* but differs in the one-celled spores. The species, *Carlosia lusitanica*, was found on granitic rocks in Portugal.

SANDSTEDE, HEINR. Die Cladonien des Nordwestdeutschen Tieflandes und der Deutschen Nordseeinseln. III. Abh. Naturw. Ver. Bremen, XXV, pp. 89–243 (1922).
Critical review of published specimens.

SÁNTHA, L. Beiträge zur Flechtenflora der Umgebung von Kapronca. Bot. Közlemények, XX, pp. 56–66 ([1922] 1923). Hungarian.
Paper not seen.

SAVICZ, V. P. De Peltigeraceis e Kamczatka notula. Petrograd, 10 pp. (1922). Russian with Latin résumé.

—— Note sur l'Association des Lichens et des Mousses aux Environs de la ville Augustow du Gouvernement Suwalki (Pologne). Bull. Jard. Bot. Républ. Russie, XXII, 2, Leningrad, pp. 135–41 (1923). Russian with French résumé, p. 141.
Three associations of lichens and mosses in pine forests are described: (1) on the branches of the trees, (2) on the soil, and (3) on the trunks of the trees.

—— Stereocaulacearum e Kamczatka descriptio. Notulae systematicae ex Inst. Crypt. Horti Bot. Petrop. II, N. 11, pp. 161–76 (1923). Russian with Latin résumé.
The author records a number of new forms and the discovery of *Phyllocaulon Wrightii* with apothecia; a diagnosis of the latter is given. (Better known as *Stereocaulon Wrightii* Tuck. recorded from N. Asia and Japan.)

—— De lichene, *Cetraria Richardsonii* Hook. notula. Tom. cit. N. 12, pp. 189–91.
An account of *Cetraria Richardsonii* in Russian. Synonymy and localities are added in Latin.

—— *Lichenotheca Rossica*. Op. cit. III, N. 12, pp. 1–3 (1924).
A list of 10 published species. A species and a form new to science are included and described: *Cornicularia tenuissima* f. *campestris* and *C. steppae* sp. nov.

—— (1) De *Cetraria chrysantha* Tuck. nec non *C. lacunosa* Ach. in Rossia notula, (2) De lichene terrestri novo *Cornicularia steppae* mihi nec non lichene, *Cornicularia tenuissima*. Tom. cit. N. 12, pp. 181–8 (Leningrad, 1925).

SAVICZ, V. P. Die Resultate lichenologischer Untersuchungen in Weissrussland, im Jahre 1923, 33 pp. (Minsk, 1925). Russian with German résumé.

—— Existiert *Parmelia kamtschadalis*? Eine Erwiderung an K. S. Mereschkowsky. Hedwigia, LXIV, pp. 231–2 (1924).

Savicz holds that the above species is a tropical plant. He designates the northern plant as *P. cirrhata* with two varieties: var. *americana* and var. *oceano-asiatica*, the latter occurring in Kamtschatka.

—— Lichenotheca Rossica. Notulae Syst. Inst. Crypt. Horti Bot. Princip. U.S.S.R. IV, N. 3, pp. 34–7 (1926).

A second instalment of 10 numbers. One new species is described: *Cetraria libertina* E. Stuckb.

—— Flechten aus Tobolsk (Sibirien) gesammelt von B. M. Gorodkov im Jahre 1915. Travaux Musée Bot. Acad. Sci. de l'U.S.S.R. pp. 87–106 (1926). Russian with German résumé.

Previous collections by Gorodkov in the neighbourhood of Berezow gave a considerable list of species. This further study adds a number of species, one new to science: *Pertusaria stalactizoides*.

SAVICZ, V. P., and L. J. SAVICZ. Kurzer vorläufiger Bericht über die Erforschung der Moos- und Flechten-Flora Weissrusslands im Sommer, 1923, 16 pp. (Minsk, 1924). Russian with German résumé.

In this first paper a sketch is appended in German of the various associations of mosses and lichens determined by the authors.

SERVIT, M. Dvě československé lokality lišejníku *Belonia russula* Koerb. Časopis Národního Musea, Prag, p. 139 (1925).

Two new localities for the lichen *Belonia russula* in Czecho-Slovakia. See also Hedwigia, LXVI, Beiblatt, p. 74 (1926).

It is noted that the spores measure 80–90μ long.

SMITH, A. LORRAIN. Lichen Dyes. Trans. Brit. Mycol. Soc. XI, pp. 45–50 (1926).

An account of lichen-dyeing industries, the composition and occurrence of the dye-acids and the methods of collecting and preparing the dye-lichens.

—— Cryptotheciaceae. A Family of Primitive Lichens. Tom. cit. pp. 189–96, 1 pl.

—— A Monograph of British Lichens. Part II, ed. 2. Printed by Order of the Trustees of the British Museum, 447 pp., 63 pls. (1926).

SMITH, A. LORRAIN, and M. C. KNOWLES. Lichens of the Dublin Foray. Trans. Brit. Mycol. Soc. XI, pp. 18–22 (1926).

The conditions and the types of lichen vegetation in the various districts are described. Altogether 191 species and varieties were identified; several were new to Ireland.

SOMMIER, S. Flora dell' isola di Pantelleria. Firenze, Ricci, 110 pp. (1922). See Bull. Soc. Bot. Fr. LXXI, p. 1251 (1924).

A list with critical notes of cryptogams, of which 47 are lichens.

STEINER, J. Wissenschaftl. Ergeb. der Exp. nach Mesopotamien, 1910: Lichenes aus Mesopotamien und Kurdistan sowie Syrien und Prinkipo. Ann. Naturhist. Mus. Wien, XXXIV, pp. 1–68 (1921).

The lichens enumerated belong mostly to well-known European genera; many of the species are new; the large majority are saxicolous. The paper was prepared before the lamented death of the author and has been issued by A. Zahlbruckner.

STUCKENBERG, ELISABETH. Recherches sur les Cladonies des Gouv. de Penza et de Saratow. Russia, Penza, pp. 1–69 (1917). Short French résumé.

The author gives a critical account of 24 species (51 varieties and forms).

—— Lichenis novi *Cetraria libertina* mihi descriptio. Notulae Syst. Inst. Crypt. Horti Bot. Princip. U.S.S.R. IV, N. 3, pp. 31–4. Russian with Latin diagnosis.

The new species resembles *Cetraria islandica* but differs in bearing branched cilia and isidia.

SUMMERHAYES, V. S., and C. S. ELTON. Contributions to the Ecology of Spitsbergen and Bear Island. Journ. Ecology, XI, pp. 214–86, 3 pls., 7 figs. (1923).

A considerable number of lichens are included in the various plant associations, especially those on soil and on rock.

SUZA, JINDRICH. Lichenes Slovakiae. I. Acta Bot. Bohemica, I, pp. 25–39 (1923). A first instalment.

—— Lichenes Slovakiae. II. Op. cit. IV–V, pp. 3–20 (1925–6).

The lichens were collected in the Carpathian mountains in Slovakian territory. Localities, habitats, etc. are recorded in Latin.

—— Sketch of the Distribution of Lichens in Moravia with regard to the conditions in Europe (with English Summary). Publ. Facul. Sci. Univ. Masaryk, 152 pp., 10 figs. (1925).

"A phytogeographical comparative study."

—— Lišejníky Podkarpatské Rusi. Die Flechten Karpathorusslands. (Slovakian with German résumé.) Zvl. otisk Sborn. Přírodov. společ. Mor. Ostravě, III, pp. 1–18 (1924–5).

The lichens enumerated are from sandstone, moss cushions, etc., a less conspicuous flora than on the granite or limestone of the high Tatra. In the virgin forests large foliose Parmeliae and Cetrariae were collected, and in moist situations *Usnea longissima*, *Alectoria thrausta*, *Parmelia sinuosa*, etc.

—— Notes sur la flore épiphytique des lichens des chênaies près de Terešva (Russie Subcarpathique) (French résumé). Op. cit. VII, pp. 1–4 (1925).

Notes on the oaks of great size and age, part of the virgin forest near the frontier of Czechoslovakia and Roumania. The epiphytic lichen flora is described. Over 60 lichens are listed.

—— Lišejníky Československých Karpat. Les Lichens des Carpathes Tchécoslovaques (French résumé). Op. cit. VIII, pp. 1–16 (1925).

The list deals only with the larger lichens, including a number of Cladoniae; *Dufourea madreporiformis* is recorded from lime soils in the highest regions of the Tatras.

TAGDELL, ALFRED J. Mount Bagong and its Flora. Victorian Naturalist, XLI, pp. 56–80 (1924).

A few lichens are included from heights of about 6000 ft. The mountain is formed of gneiss.

TIMKÓ, GYORGY. Beiträge zur Flechtenflora von Polen. Bot. Közlemén. XIX, pp. 84–8 (1920–21). Hungarian with German résumé.

—— Új adatok a Budai és Szentendre (Neue Beiträge zur Kenntniss der Flechtenvegetation des Buda-Szentendre-Visegráder Gebirges. Op. cit. XXII, pp. 81–104 (1925). Hungarian with German résumé.

The locality is described and 250 species listed.

TOBLER, F. Vorkommen und Abbau von Flechtenstärke. Ber. Deutsch. Bot. Ges. XLI, pp. 406–9 (1923).

—— Biologie der Flechten. Gebrüder Borntraeger, Berlin, pp. viii–266, 1 col. pl., 67 figs. (1925).

—— Zur Physiologie der Farbunterschiede bei Xanthoria. Ber. Deutsch. Bot. Ges. XLIII, pp. 301–5 (1925).

TOMIN, M. P. Les Formes oecologiques intéressantes de quelques lichens fruticuleux, rencontrées dans le gouvernement de Smolensk. Mém. Inst. Agron. Voronèje, III, pp. 46–54, 1 pl. (1918). French résumé.

—— Matériaux pour la Flore des Lichens du Gouvernement de Smolensk. Tom. cit. pp. 105–28, 1 pl. French résumé.

A list of lichens collected by the author. Two new species and one form were discovered and described.

Tomin, M. P. De forma nova Rinodinae nimbosae (El. Fr.) Th. Fr. form. sareptana Tomin. Notulae Systematicae ex Inst. Crypt. Horti Bot. Petrop. pp. 78–80 (1923).

A form distinguished by the caesio-pruinose apothecia without thalline margins. Collected in Sarepta, province Tsaritsyn.

—— De *Buellia* nova in Russia Media inventa. Tom. cit. pp. 139–40.

The new lichen *Buellia Elenkini* was found on birch trees. Thallus granular-leprose with a black limiting hypothallus; spores 1–4 septate and sometimes muriform, 22–28μ × 8–13μ.

—— Beiträge zur Lichenen-Flora des Gouvernements Woronesh. Russian with German résumé. Woronesh, 14 pp. (? 1926).

Tomin has examined a number of collections and records 145 species and forms. There is one new to science, *Dermatocarpon subcinereum*.

—— Neue Flechten aus Süd-Ost. Russland. Russian with German résumé. Woronesh, 8 pp. (1926).

The lichens were collected in the Gouvern. Astrachan. Several new species are described.

—— Enumeratio Licheninir Austro-Ussuriensium. Bull. Southern Ussuri Branch State Rus. Geogr. Soc. Russian, N. 12, pp. 211–24 (1926).

A record of 85 species including several new to science: *Placodium Gordejevi, Anaptychia isidiata* and *Pyxine sibirica*.

Trümpener, Egon. Ueber die Bedeutung des Wasserstoffionenkonzentration für die Verbreitung von Flechten. Beih. Bot. Centralbl. xlii, 3, pp. 321–54 (1926).

Uphoff, T. C. Th. The Occurrence of Purple Bacteria as Symbionts of a Lichen. Amer. Journ. Bot. xii, pp. 97–103, 1 fig. (1925).

Vainio, E. A. Lichenes in summo monte Doi Sutep (circa 1675 ms.) in Siam boreali anno 1904 a C. C. Hosseo collecti. Ann. Soc. Zool. Bot. Fenn. Vanamo, 1, pp. 33–55 (1923).

Many of the species are new to science, nearly all those listed are corticolous.

—— Lichenes in Insula Trinidad a Professore R. Thaxter collecti. Proc. Americ. Acad. Arts and Sci. lviii, 131–47 (1923).

A list of 64 species from the W. Indies. Many of them are new to science. The majority are small crustaceous species.

—— Lichenes Teneriffenses. Mém. Acad. Roy. Sci. et Lettres Danemark, sér. 8, vi, pp. 392–3 (1924).

Lichens collected by Börgesen during an expedition to the Canary Islands. *Roccella Boergesenii* is new to science. The species are mostly European and common in temperate countries.

—— Lichenes A. W. A. Setchell et H. E. Parks in Insula Tahiti a 1922 collecti. Univ. Calif. Publ. Botany, xii, N. 1, pp. 1–15 (1924).

Most of the species are new to science.

—— Lichenes Tahitensis. Univ. Calif. Publ. Bot. xii, pp. 1–16 (1924).

Many of the species described are new to science.

—— Lichenes Mexicani a F. M. Liebmann annis 1841–43 collecti, in Museum Hauniensi asservati. Dansk. Bot. Ark. iv, N. 11, 25 pp. (1926).

An old collection from the neighbourhood of Orizaba now described. The list includes many new species.

—— Lichenographia Fennica. I. Pyrenolichenes usque proximi Pyrenomycetes et Lichenes Imperfecti. Acta Soc. Faun. et Fl. Fenn. xlix, pp. 1–274 (1921).

—— Lichenographia Fennica. II. Baeomyceae et Lecideales. Op. cit. liii, pp. 1–340 (1922).

Watson, W. Lichenological Notes. I. Journ. Bot. lxiii, pp. 130–2 (1925).

Two new species are recorded: *Stenocybe bryophila* on stems of hepatics and *Clathroporina calcarea*, the latter a tropical genus and species new to Britain.

WATSON, W. Lichenological Notes. II. Op. cit. LXV, pp. 109–13 (1927).

—— The Bryophytes and Lichens of Arctic-Alpine Vegetation. Journ. Ecology, XIII, pp. 1–25 (1925).

WERNER, R. G. *Xanthoria parietina* lichen, son champignon en culture pure. Bull. Soc. Mycol. France, XLI, pp. 585–7, 1 pl. (1923).

WYSSOLZKY, G. N., L. I. SAVICZ und V. P. SAVICZ. Durch das südliche Weissrussland. Beobachtung während der botanischen Excursionen. (Russian with German résumé.) 51 pp. Minsk, 1925.

A considerable number of lichens were collected and determined by V. P. Savicz.

YASUDA, A. Die Flechten Japans. Sendai, 1925, pp. 118, tab. 24. See Ann. Mycol. XXV, p. 191 (1927).

ZAHLBRUCKNER, A. Ueber die Sexualität der Flechten. Verh. Zool. Bot. Gesell. Wien, LXXIII, pp. 48–9 (1924).

Notes of a discussion on sexuality in lichens.

—— Die Flechten der Osterinsel, nebst einem Nachtrag zu der Flechtenflora von Juan Fernandez. Nat. Hist. of Juan Fernandez and Easter Island by Dr Carl Skottsberg, II, pp. 449–60 (1926).

—— Catalogus Lichenum Universalis. Leipzig, Borntraeger, I, 696 pp. (1922); II, 815 pp. (1924); III, 899 pp. (1925).

—— Chilenische Flechten gesammelt von C. Skottsberg. Göteborgs Botaniska Trädgård, II, pp. 1–26 (1925–6).

—— Afrikanische Flechten (Lichenes). Engler, Botanische Jahrbücher, LX, pp. 469–552 (1926).

—— Beiträge zur Flechtenflora Niederösterreichs. Verh. Zool. Bot. Gesell. Wien, LXXVI, pp. 76–98 (1926).

—— Spiegazione delle Tavole Lichenologiche inedite di Abramo Massalongo. Estratto del volume giubilare "Abramo Massalongo, 1824–1924." Verona, 1926. 9 coloured plates of lichens.

—— Lichenes (Spezieller Teil). Engler und Prantl, Die Natürlichen Pflanzenfamilien, VIII (Zweite Auflage), pp. 61–270, 127 figs. (1926).

ZEDROSSER, TH. Die Flechten des Lavanttales. Carinthia, II. Mitt. Naturhist. Landesmus. Karnten, 34 and 35, pp. 29, 38. Klagenfurt (1925). See Hedwigia, LXVI, Beiblatt, p. 101 (1926).

ZIEGENSPECK, H. Ueber Jod unter Blaufärbung-Stoffe in den Asci von Flechten. Ber. Deutsch. Bot. Ges. XLII, pp. 116–19 (1924).

ZSCHACKE, HERMANN. Die mitteleuropäischen Verrucariaceen. I. Hedwigia, LIV, pp. 183–98, 1 pl. (1914). II. Op. cit. LV, pp. 286–34, 3 pls. (1914). IV. Op. cit. LXV, pp. 46–64 (1924).

—— Die Flechten des Davoser Tales. Mittel. Naturf. Ges. Davos, 59 pp. (1925–6).

A large collection of lichens made by Zschacke during internment at Davos. He lists them first according to substratum and follows with a classified account.

SEPTOBASIDIUM RAMEALE.

(With Plates XVIII and XIX.)

By T. Petch, B.A., B.Sc.

In *The Fungi of Ceylon*, No. 605 (1873), Berkeley and Broome described *Lachnocladium rameale* B. & Br., "Atropurpureum filiforme furcatum, apicibus acutis, basi setis tenuibus mixtum; mycelio tenuissimo albo (No. 595). On living branches; running up the petioles of the leaves, and sometimes on the leaves themselves. Ambagamowa, Sept. 1862." We will refer to this as species *A*, in the hope that the following account will thereby be the more intelligible. The fungus consists of a number of stout, erect, close-set bristles, which present a surface resembling that of a hair brush. Sometimes it completely surrounds a stem, and then it has the appearance of a bottle brush, or a pipe cleaner (Plate XVIII, figs. 4, 5).

In *The Fungi of Ceylon*, No. 611 (1873), Berkeley and Broome described *Hymenochaete ramealis* Berk., "Ambiens, coffeicolor, confluens, margine late reflexo, extus zonata strigosa. On branches of living shrubs. Nuwara Eliya, Jan. 1847. Running down the stems for several inches; margin on either side broadly reflexed." The species was attributed to Berkeley, instead of Berkeley and Broome, apparently because Berkeley had had the specimen in hand since 1847, it being one of the fungi sent by Gardner. Cooke, in *Grevillea*, VIII, p. 150 (1880), stated that the type specimens resembled *Hymenochaete* in habit but were without setae. Massee, in his *Monograph of the Thelephoreae*, pt 2, p. 187 (1890), transferred this species to *Stereum*, repeating Berkeley's description with the addition "hymenio glabro; sporae subglobosae, 5μ." We will refer to this as species *B* (Plate XIX, fig. 1).

In *The Fungi of Ceylon*, No. 575, Berkeley and Broome had described *Thelephora suffulta* B. & Br., and added the note: "The same species was sent by Gardner on living shrubs from Ramboda, Jan. 1847, but with the supporting hairs scattered." In Herb. Kew., there is the type of *Thelephora suffulta* (Thwaites 669), another specimen, Thwaites 152, and in the same cover, Gardner's specimen from Ramboda, January 1847. The three fungi are all different species, the Ramboda specimen being *Hymenochaete ramealis*, species *B*. The two Kew specimens of species *B*, under *Hymenochaete ramealis* and *Thelephora suffulta* respectively, were collected by Gardner in the same month and in the same neighbourhood. Ramboda is the name of the pass

leading up to Nuwara Eliya. Thwaites 152 is apparently not *Septobasidium*, but an immature Dematiae, probably *Graphium*.

In *Grevillea*, XIX, p. 108 (1891), Cooke stated that *Thelephora suffulta* B. & Br. was only a form of *Thelephora pedicellata* Schw., but he did not state on which of the Ceylon specimens in the cover of *Thelephora suffulta* he had based his decision. It would appear quite impossible that it could have been based on Thwaites 669, the type of *Thelephora suffulta*. Patouillard, *Bull. Soc. Myc. France*, XXIV, p. 2 (1908), referred *Thelephora suffulta* B. & Br. to *Septobasidium*, and the true *Thelephora suffulta* does not come further into this discussion.

In *Annals of Botany*, XXV, p. 843 (1911), the writer, in a note on the biology of the genus *Septobasidium*, referred to *Lachnocladium rameale* B. & Br. as a *Septobasidium*, without, however, actually employing the combination *Septobasidium rameale*. This reference was to species *A*.

Bresadola (*ante* 1915) examined the specimens of Basidiomycetae in the Kew herbarium, and made notes on the herbarium sheets. Under *Lachnocladium rameale* (species *A*), he noted: "Ce n'est pas un *Lachnocladium*, mais l'état avortif d'un *Septobasidium* que je crois d'avoir de Philippines et que je dénommerais *Septobasidium rameale* (B. & Br.)." He added a portion of the Philippine specimen to the herbarium sheet, and that specimen is species *B*.

Under *Thelephora suffulta*, Bresadola attached to the specimen, species *B*, Gardner, Ramboda, Jan. 1847, the note, "hoc specimen diversum et potius ad *Septobasidium rameale* ducendum."

Hence Bresadola named his Philippine specimen, *Septobasidium rameale*, on the supposition that it was the same species as *Lachnocladium rameale* B. & Br., species *A*, which it is not. But at the same time he correctly referred to his Philippine species, Gardner, Ramboda, 1847, which is species *B*, *Hymenochaete ramealis* Berk. Therefore, although Bresadola's reason for choosing the name *Septobasidium rameale* was wrong, the name would still have been the correct one for his species (with the substitution of Berk. for B. & Br.), if the combination had not been previously applied to a different species. For the purist in nomenclature, this raises the question whether the statement in *Annals of Botany*, XXV, p. 843 (1911), was effective publication.

Lloyd, in *Mycological Notes*, No. 61 (1919), described and figured *Septobasidium rameale* from the type of *Lachnocladium rameale* B. & Br., *i.e.*, species *A*. At the same time he described a new species, *Septobasidium alatum*, from the Philippines, and stated that his species was based on Macgregor 20385, which had been misreferred to *Septobasidium rameale*. His description

states that *Septobasidium alatum* has no hyphal pillars, and that the basidia are hyaline, cylindric, septate, and curved.

In *Ann. Myc.* XX, p. 66 (1922), Sydow stated that *Septobasidium alatum* Lloyd, according to the description and figure, and his examination of the original specimen, was identical with *Septobasidium granulosum* Syd. in Engler's *Bot. Jahrb.* Bd. LIV (1916), p. 253. Herr H. Sydow has kindly furnished me with a specimen of *Septobasidium granulosum*, and it proves to be quite different from *Lachnocladium rameale* B. & Br. (species *A*) and *Hymenochaete ramealis* Berk. (species *B*). It agrees with the latter in having a free projecting margin, but it has no hyphal pillars. The intermediate layer consists of loosely interwoven hyphae, while the hymenial layer is peculiar in being formed by separate tufts of hyphae arising from the intermediate layer and closely packed side by side to present a continuous surface (Plate XVIII, fig. 3).

Apart from the foregoing error, misunderstanding has arisen through Berkeley and Broome's use of the same specific name for two different fungi, both of which are now recognised to be *Septobasidium*. Bresadola's species from the Philippines is not identical with *Septobasidium rameale* (B. & Br.) = *Lachnocladium rameale* B. & Br. (species *A*), as he thought; but it is identical with *Septobasidium rameale* (Berk.) = *Hymenochaete ramealis* Berk. (species *B*).

Patouillard, in *Bull. Soc. Myc. France*, XXXVI, p. 175 (1920), redescribed *Lachnocladium rameale* B. & Br. as *Septobasidium rameale* (B. & Br.) Petch (non *Hymenochaete ramealis* Berk.). He recorded it on branches of living trees, attacked by coccids, in Annam and Tonkin. His description and notes are:

"Très rarement fructifié. Les probasides naissent isolément sur les hyphes de la périphérie ou à leur extrémité; ce sont des vésicules globuleuses (15μ de diam.), ou ovoïdes allongées (50 × 10μ), incolores ou brunâtres, à parois minces.

"Cette plante ne doit pas être confondue avec *Hymenochaete ramealis* B. & Br., qui est *Septobasidium rameale* Bres. (non Petch), et aussi *S. alatum* Lloyd, *Mycol. Notes*, No. 61, p. 888, espèce d'abord entièrement résupinée devenant avec l'âge plus ou moins réfléchie et presque dimidiée, dont les probasides ovoïdes (12–15μ) donnent naissance à des basides triseptées, droites ou courbées."

As we have already seen, *Septobasidium alatum* Lloyd (*granulosum* Syd.) must be deleted from the synonymy of both species *A* and species *B*.

Subsequently, Patouillard found that species *A* had been named several years before it was described by Berkeley and Broome. It was described and figured in 1834 by Montagne in

the section on fungi in Belanger, *Voyage aux Indes Orientales, pendant les années* 1825–1829, from specimens collected in Southern India, under the name *Hydnum? pteruloides* Mont. The original specimens, which are still in Herb. Montagne, were examined by Patouillard, who found that they were the same as *Lachnocladium rameale* Berk. Patouillard published the name *Septobasidium pteruloides* (Mont.) Pat. in *Bull. Soc. Myc. France*, XLI, p. 337 (1925).

Species *A* thus becomes *Septobasidium pteruloides* (Mont.) Pat. (1925); *Hydnum? pteruloides* Mont. (1834); *Lachnocladium rameale* B. & Br., *Journ. Linn. Soc.* XIV, p. 67 (1873); *Septobasidium rameale* (B. & Br.) Petch, *Ann. Bot.* XXV, p. 843 (1911) and in Patouillard, *Bull. Soc. Myc. France*, XXXVI, p. 175 (1920); non *Septobasidium rameale* (B. & Br.) Bres. in Herb. Kew.

Whether the name *Septobasidium rameale* can now be employed for species *B* will depend on the code followed by the individual mycologist. In view of the confusion attendant on the use of that name, it would seem preferable to rename species *B*, and I would accordingly name it *Septobasidium aligerum*. Its synonymy is

Septobasidium aligerum Petch; *Hymenochaete ramealis* Berk., *Journ. Linn. Soc.* XIV, p. 68 (1873); *Stereum rameale* (Berk.) Massee, *Journ. Linn. Soc.* XXVII, p. 187 (1890); *Septobasidium rameale* Bres. in Herb. Kew.; *Septobasidium rameale* (Berk.) Bres. in Petch, *Trans. Brit. Myc. Soc.* VII, p. 34 (1921).

Septobasidium pteruloides (Mont.) Pat.

This species has been found on comparatively few occasions in Ceylon, at Hakgala (5600 ft.) and Nuwara Eliya (6200 ft.). It grows over colonies of scale insects on branches up to a centimetre in diameter, along which it may run for a length of about six inches, completely surrounding the branch. In colour it is violet or purple-black when fresh, with a narrow white margin. The basal layer is thin, and composed of repent purple-brown hyphae, more or less parallel to one another; towards the margin many of the hyphae are arranged in fascicles and some are hyaline. Another thin layer is formed over the basal layer, not continuously, but leaving oval gaps, up to 2 mm. long and 0·5 mm. wide; and from the edges of these gaps there arise erect bristles, which are consequently arranged in rings. These rings are best seen towards the margin of the stroma where the bristles are in the early stages of development (Plate XIX, fig. 4). A little distance back from the margin the bristles are 30–50μ diameter at the base, tapering upwards to a point; they are erect fascicles of more or less parallel hyphae, with a few free hyphal ends spreading out at a wide angle. These bristles

grow until they attain a height of about 6–10 mm. Several of them, up to half a dozen, may fuse together to form these larger "clavae," which may be 0·5 mm. in diameter. These clavae are generally simple with acute tips, but they may be forked at any height, or the apex may consist of a cluster of points, as though the original constituent bristles had separated again there.

Most of the available specimens of this species are sterile. In one collection, however, Hakgala, April 1919, the clavae bear probasidia scattered along their whole length. In this specimen, the clavae had lost their purple-black colour, and were pale purple-brown when fresh and greyish when dry; in some instances they were up to 10 mm. high, and rather loose above, and had fallen together laterally so that they resemble a tuft of *Stemonitis* (Plate XIX, fig. 3).

The clavae are composed entirely of longitudinal hyphae. The probasidia are situated laterally or terminally on the outer hyphae, either scattered, or in small groups; they are thin-walled, globose, 8–10μ diameter, or pyriform, up to 15 × 10μ. Basidia and spores have not been observed.

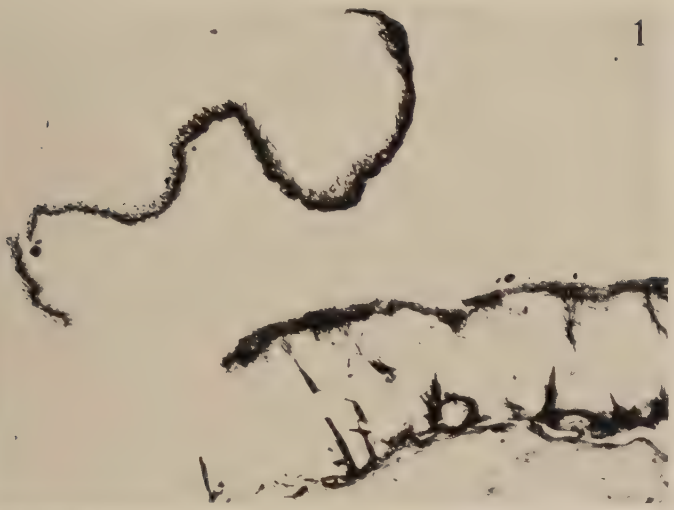
The most remarkable feature of this species is that it does not form an "upper deck," *i.e.* a hymenial layer uniting the apices of the bristles and supported by them. Instead, the bristles develop into clavae which bear the hymenium along their whole length.

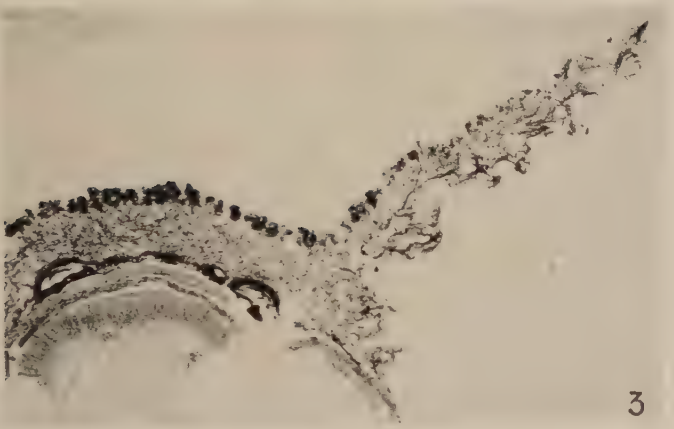
Septobasidium aligerum Petch.

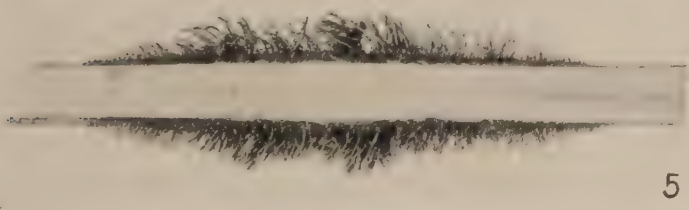
Septobasidium aligerum is a common species "up-country" in Ceylon, descending to about 4000 ft. It is found on shrubs in the jungle, overrunning stems and leaves, and frequently occurs in gardens on orange trees infested by scale insects. On the latter, it may cover all the branches for almost their whole length.

The basal layer is a thin resupinate film, 40–60μ thick, purple or purple-black in colour. From this layer arise slender black or black-brown bristles up to 1·25 mm. high, which are rigid, erect fascicles of hyphae, 0·05 mm. in diameter at the base, tapering upwards. These bristles are scattered in no particular order, about 0·1–0·2 mm. apart (Plate XIX, fig. 2).

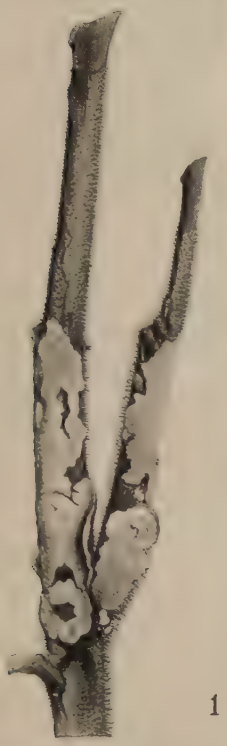
From the apices of these bristles, the hyphae spread out laterally in a small, more or less circular disc, and these discs unite, so that a continuous upper layer is formed, supported by the bristles. When fully developed this upper layer is 0·1–0·15 mm. thick, and purple-grey. The outer surface of this is the hymenial layer. In the natural position of the fungus this surface faces downwards. The basal layer with its forest





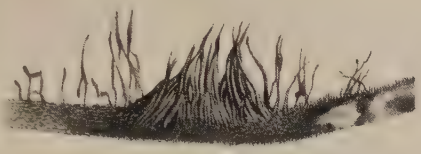


SEPTOBASIDIUM



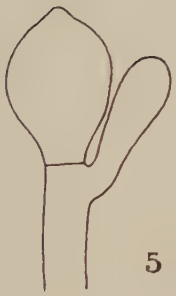
1

2

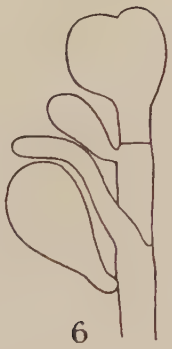


3

4



5



6

7

SEPTOBASIDIUM

of bristles usually extends beyond the upper layer (Plate XIX, fig. 1).

The foregoing method of development is common to many species of *Septobasidium*. *Septobasidium aligerum*, however, in its further development, shows a peculiarity which appears to occur in few other species. When growing along a branch, the formation of the upper layer begins on the bristles on the lower surface of the branch. When this has extended about half way round the branch, it may be continued up the sides and over the upper surface of the branch, as in other species of *Septobasidium*, but, perhaps more generally that does not happen. Instead, the upper layer grows out from the sides of the branch as a free pileus, up to a centimetre broad. As the fungus usually grows on small branches, it nearly always forms this free pileus. The habit is similar to that of *Hymenochaete tenuissima*.

The upper surface of the free pileus is radially strigose with coarse fascicles of hyphae, and frequently zoned parallel to the margin. As a rule, it is readily seen that the pileus is continuous with a resupinate part supported by bristles. Sometimes, however, the hinder margin of the pileus fuses with the basal layer, so that the bristles are hidden from view; and in old specimens the bristles beneath the resupinate part may collapse or may be hidden by a further growth of hyphae from the basal layer. This appears to have been the case with the type specimen of *Hymenochaete ramealc* Berk., which is an old, weather-worn specimen. In some cases, the bristles project through the hymenium. These bristles are present in the type specimen of *Hymenochaete ramealis*, chiefly on the basal layer above the reflexed pilei; and, from Berkeley's reference of that specimen to *Hymenochaete*, it would appear probable that he saw them. When old, the fungus becomes purple-brown or rufous brown. Probasidia have not been observed.

This is the species distributed at the Minehead Foray (1920) as *Septobasidium rameale*, and referred to in *Trans. British Myc. Soc.* VII, p. 34, as *Septobasidium rameale* (Berk.) Bres.

EXPLANATION OF PLATES.

Plate XVIII.

Fig. 1. *Septobasidium aligerum*. Section. × 20. This is from an old herbarium specimen; the pillars are broken, and the wing detached.

Fig. 2. *S. aligerum*. Section showing an unbroken pillar. × 20.

Fig. 3. *S. granulosum*. Section. × 20. The cavities at the base of the fungus indicate the positions of the host insects.

Fig. 4. *S. pteruloides*. × ¾.

Fig. 5. *S. pteruloides*. Longitudinal section of the specimen of Fig. 4. × ¾.

PLATE XIX.

Fig. 1. *Septobasidium aligerum*. Natural size.
Fig. 2. *S. aligerum*. Longitudinal section of the host branch, showing advancing edge of stroma. × 8.
Fig. 3. *S. pteruloides*. A cluster of clavae bearing probasidia. Natural size.
Fig. 4. *S. pteruloides*. Advancing edge of stroma. × 6.
Figs. 5–7. *S. pteruloides*. Developing probasidia. × 1200.

THE INFLUENCE OF ENVIRONMENT ON THE INFECTION BY LIGNIERA JUNCI.

By W. R. Ivimey Cook, B.Sc.

IN a recent paper (4) reference was made to an observation of Schwartz (7) concerning the peculiar habitat of five species of *Ligniera* which he described. Examination of water plants from various similar habitats over the south of England has shown that *Ligniera* occurs in other parts of the country, but nowhere has it been found so abundantly as in the neighbourhood of Knole Park, Sevenoaks, Kent. It would seem, therefore, that there is something about the locality which is particularly favourable for the development of the fungus.

Cross-inoculation experiments (4) have shown that so far only one species of *Ligniera* is known to occur in this country and it is therefore assumed that the various records from other localities in Southern England refer to the same species, *Ligniera Junci*.

In the spring of 1926 an attempt was made to determine what physiological factors favoured the growth of the fungus.

At the present time much importance is attached to the hydrogen ion concentration of the soil or water in which plants are growing, and a determination of the acidity of the water in the pond was therefore made. It was found to be slightly acid, *p*H 5·5. It was also noticed that there was an excess of iron in the water, and it was thought that these two factors might be of importance in explaining the abundance of the fungus in this particular locality. Accordingly during the spring of that year experiments were set up to test these points.

METHODS.

Three series of experiments were finally used, although attempts were made to carry out a fourth series. In Series I thirty plants were used, in Series II, sixteen, and in Series III, fifteen plants. The plants were grown in flat, open glass jars

about 12 cm. in diameter and 5 cm. deep, with a capacity of slightly over 250 c.c. *Callitriche stagnalis* and *Ranunculus aquatilis* were found most suitable for the experiments. In the fourth series an attempt was made to use *Ranunculus circinatus*, but the conditions under which the cultures were grown did not favour the growth of this plant and the series was later discarded.

Two hundred cubic centimetres of Sachs' Culture Solution were placed in each jar, and, in Series II, about half an inch of sterilised silver sand was added to cover the roots of the plants. Iron, in the form of ferric chloride, was added in excess of what is normally used in this culture solution, about 2 c.c. of a ten per cent. solution being used.

In Series I, plants of *Callitriche stagnalis* were collected from one of the ponds at Knole Park, and roots examined before the cultures were set up were found to be heavily infected with *Ligniera Junci*. A quantity of infected material was also kept in a large bell jar, with soil at the bottom, and at the end of the experiments the roots were still found to be infected.

In Series II the plants of *Ranunculus aquatilis* were collected at Beckenham, Kent, from a pond in which *Ligniera Junci* has not been found. They were planted in the same way as those in Series I, except that the roots were immersed in silver sand which had been autoclaved twice for several hours at a temperature of 110° C. to ensure its being free from infection. Control material from the same pond was kept in the greenhouse throughout the experiments and at the end was found to be still free from disease.

Series III resembled Series I in all respects except that the material used was free from the fungus. It was collected from the same pond at Beckenham as the *Ranunculus aquatilis*. Control plants were also grown in a bell jar in their native soil and remained free from infection throughout the summer.

Twenty-four hours after a culture had been set up the *p*H value of the solution was determined. 5 c.c. of the culture solution was tested with Universal Indicator. The *p*H values selected were purely arbitrary. It was desired to have one set of plants growing in distinctly acid solution, and for these a *p*H of 5 was used, others in a strongly alkaline solution, at about *p*H 10, while a third set should be maintained at about *p*H 7, or as near neutrality as possible. The method used was thus somewhat crude. The continual change which took place in the composition of the culture solution due to the action of the plants and the gradual absorption of carbon dioxide from the air, caused considerable alteration in the *p*H value after the culture had been set up. The relative acidity or alkalinity was, therefore, tested each week and the value brought back by

the addition of either acid or alkali. On the whole there was a general tendency for all cultures to become more alkaline.

After a culture had been growing for from seven to eight weeks, each plant in Series II and III was inoculated with infected material by planting in the jar diseased plants of *Callitriche stagnalis* in Series II, and *Ranunculus aquatilis* in Series III.

In the course of cross-inoculation work which had been carried out previously it was found that the disease can be contracted in about fourteen days. The plants in Series II and III were allowed to continue growing for from three to four weeks; at the end of that time the plants used for infection were removed and the culture plants in all the series were collected and preserved separately in alcohol for examination.

The experiments were carried out in the roof greenhouses at King's College, London. These houses are very exposed, and despite very great care in shading the plants at all times with green shading, and during sunny weather with additional brown shades just above the jars, the temperature rose as high as 105° F. As a result of this the leaves, particularly those of *Ranunculus aquatilis*, became brown and sometimes slightly withered. This, however, did not seem to affect the actual growth and vigour of the plants which appeared as healthy as those grown in large bell jars under as far as possible normal conditions.

There was a considerable loss of water in the jars due to evaporation, but this loss was made up daily by the addition of distilled water, which was prepared in the department using only glass apparatus, in order to prevent the introduction of any copper or other minerals, which might be deleterious to the zoospores of *Ligniera Junci*.

Results.

Table I. *Infected plants of* Callitriche stagnalis *grown in three series of jars at different* pH *values. Planted March 25th, examined July 3rd.*

Plant No.	Mean pH value obs.	Infection obs.	Plant No.	Mean pH value obs.	Infection obs.	Plant No.	Mean pH value obs.	Infection obs.
A. 1	6	—	A. 11	7	—	A. 21	10	—
A. 2	6	—	A. 12	7	+	A. 22	10	—
A. 3	5	—	A. 13	7	—	A. 23	10	—
A. 4	5	—	A. 14	7	—	A. 24	10	—
A. 5	5	—	A. 15	7	—	A. 25	9	—
A. 6	5	—	A. 16	8	—	A. 26	10	—
A. 7	5	—	A. 17	7	—	A. 27	10	—
A. 8	5	slight	A. 18	7	—	A. 28	10	—
A. 9	5	—	A. 19	7	—	A. 29	10	—
A. 10	5	—	A. 20	7	—	A. 30	10	—

In this culture the roots were exposed and some developed chloroplasts like the stem and leaves.

Table II. *Plants of* Ranunculus aquatilis *grown in three series of jars at different pH values, and inoculated with diseased roots of* Callitriche stagnalis. *Planted April 14th, inoculated June 14th, examined July 3rd.*

Plant No.	Mean *p*H value obs.	Infection obs.	Plant No.	Mean *p*H value obs.	Infection obs.	Plant No.	Mean *p*H value obs.	Infection obs.
B. 1	6	+	B. 12	8	—	B. 21	10	—
B. 2	6	+	B. 14	8	+	B. 23	10	—
B. 7	6	+	B. 18	7	+	B. 26	10	—
B. 10	6	+	B. 35	8	+	B. 29	10	—
B. 31	7	+	B. 36	8	+	B. 30	9	—
B. 33	7	+						

In this culture the roots were buried in silver sand which had been sterilised before use. The slight alkalinity of the sand was the cause of the higher *p*H value than in Table I.

Table III. *Plants of* Callitriche stagnalis *grown in three series of jars at different pH values, and inoculated with diseased roots of* Ranunculus aquatilis. *Planted April 14th, inoculated June 3rd, examined July 3rd.*

Plant No.	Mean *p*H value obs.	Infection obs.	Plant No.	Mean *p*H value obs.	Infection obs.	Plant No.	Mean *p*H value obs.	Infection obs.
D. 1	7	+[1]	D. 6	7	—	D. 11	10	—
D. 2	6	—	D. 7	7	—	D. 12	10	—
D. 3	6	—	D. 8	8	—	D. 13	10	—
D. 4	6	+[1]	D. 9	7	—	D. 14	10	—
D. 5	6	—	D. 10	7	—	D. 15	10	—

[1] In these jars there was very considerable growth and the resultant screening of the roots by the foliage may partly explain the presence of the fungus.

In this culture the roots of both the diseased plants and those used in the experiment were exposed to the light.

Tables I, II and III show several interesting results.

In Table I infected plants of *Callitriche stagnalis* after three months in the culture solution had entirely lost the fungus, with the exception of two plants in rather acid solutions.

In Table II after three weeks, ten plants out of sixteen of *Ranunculus aquatilis* were found to have contracted the fungus from infected plants of *Callitriche stagnalis*. The plants which did not become infected were, with one exception, growing in strongly alkaline solutions.

In Table III only two plants out of fifteen became infected and these were both growing in acid solutions, but owing to the abnormally dense growth of the plants the roots were to a large extent protected from the light.

In 1925 (4) using *Callitriche stagnalis* as inoculant the following results were obtained after two months:

Plantago major	10	plants	out of	10	became	infected
Poa annua	10	,,	,,	10	,,	,,
Mentha Pulegium	4	,,	,,	5	,,	,,
Ranunculus sp.	4	,,	,,	5	,,	,,
Iris Pseudacorus	8	,,	,,	10	,,	,,

Similarly using *Ranunculus aquatilis* as inoculant the results obtained were:

Plantago major	10	plants	out of	12	became	infected
Poa annua	4	,,	,,	5	,,	,,
Mentha Pulegium	3	,,	,,	3	,,	,,
Iris Pseudacorus	9	,,	,,	10	,,	,,

It is evident, therefore, that these plants can be successfully used as inoculants of the disease into other plants. The only difference between the two series of experiments was that while those in 1926 were carried out in open jars containing a culture solution those of the previous year were done in the soil itself.

From Table II it can be seen that infection of *Ranunculus aquatilis* by diseased roots of *Callitriche stagnalis* can occur in the course of about three weeks; also that plants in acid and neutral solutions become diseased while those in alkaline solutions do not. The series of experiments was sufficient to confirm the work of the previous year that the fungus can attack plants growing only in acid or neutral soils. The water at the pond at Sevenoaks is *p*H 5·5 or slightly acid. Further the *p*H value of the soil used in the inoculation experiments in 1925 was also slightly acid.

Series I and III differed from Series II in several features; in addition to a different host plant no silver sand was placed in the jars and the roots were in no way protected either from the sun or light. An examination of Tables I and III shows that with the exception of four plants no infection was obtained at the end of from three to four weeks. In 1925 when *Callitriche stagnalis* was used to inoculate a species of *Ranunculus* whose roots were growing in ordinary soil, infection was obtained in four plants out of five. These facts seem definitely to point to the conclusion that either the fungus cannot live and propagate in the presence of light, or that roots exposed to light are not suitable for the growth of *Ligniera*. This is further brought out by the fact that in Series I, in which thirty infected plants of *Callitriche stagnalis* were used, all with two exceptions, lost the fungus in about two months. These plants were also growing in jars without protection for the roots; control plants growing in large bell jars with soil at the bottom were still heavily infected after several months and showed no sign of losing the disease.

From these two series it is concluded that light is an inhibiting factor in the propagation of the fungus, and not only do roots which are exposed to light remain free from the fungus but also roots in which the disease is already present lose their infection in the course of a couple of months.

Discussion.

The resistance of plants to the attack of a parasitic fungus may be due, either to the absence from the host tissues of anything which is advantageous to the fungus, or to the presence in the cells of the host of some substance, or substances, which are definitely toxic to the parasite. In symbiotes it is probable that the former condition occurs, and that the host either directly or indirectly aids the fungus by the formation of substances which are definitely attractive to it. Generally, however, the resistance to fungal attack seems clearly to be due to the presence of something definitely poisonous to the fungus, which may either kill the parasite, or considerably curtail its activities.

In *Ligniera Junci* we have a fungus which can infect the cells of a great variety of aquatic or semi-aquatic plants, so long as the roots are protected from light. The fungus never invades tissues which are above the soil, consequently, when inoculation is attempted in plants with roots exposed to light, no disease is found. Furthermore when plants with abundant infection are planted in culture solutions with their roots uncovered the disease soon disappears. The natural conclusions are, either that those parts of the plant which are exposed, possess in their cells some substance, in the presence of which *Ligniera Junci* cannot grow, and since infected plants lose the disease, this substance not only prevents infection, but is sufficiently poisonous to kill the fungus even when it has gained a firm hold upon the host; or that light itself kills the fungus. It is considered quite probable that the substance which is toxic to the fungus is chlorophyll.

Other factors, however, besides light play an important part in controlling infection, for *Ligniera Junci* only infects plants growing in acid or neutral soils.

Atkins (2) found that in *Plasmodiophora Brassicae* the presence or absence of calcium was a more important factor than the relative acidity or alkalinity of the soil. He instances the case of two fields; the first, having a *p*H of 6·6 and 0·17 per cent. of calcium, was heavily infected with *Plasmodiophora Brassicae*; the second, having a *p*H of 6·7 and 0·40 per cent. of calcium, was free from disease. Here the relative acidity of the two fields can be neglected, and, assuming that there were no unrecorded

differences in the other constituents of the two soils, it would seem that the excess of soluble calcium in the soil of the second field was definitely toxic to the fungus. A liberal treatment of lime is universally recognised as a method of combating an attack of this disease, but it has generally been assumed that it was the alkalinity of the lime rather than the calcium which was the inhibiting factor.

In *Ligniera Junci* the inhibiting factor is the alkalinity and not the lime, since the quantity of calcium was the same in each culture jar.

Melhus, Rosenbaum and Schultz (6) found that in *Spongospora subterranea* lime increased the quantity of infection in the soil, and this is in general agreement with the work of other investigators on *Spongospora subterranea*.

Very little work has been done in this connection with the other genera of the Plasmodiophorales. *Sorosphaera Veronicae* differs from the other genera mentioned, in occurring in the green parts of the plant. Schwartz(3) found it particularly abundant in the green stem. Although no definite observations upon the physiological factors involved have been possible, plants of *Veronica Chamaedrys* infected with the fungus are most frequently found in the same localities as *Ligniera Junci*. So far it has not been found possible to carry out experiments with *Sorosphaera Veronicae*. Infected plants carefully removed and planted in the greenhouse free themselves from the fungus in a few months. I am told by Dr E. J. Schwartz that he has obtained the same results in plants which he tried to keep in his own greenhouse, but those which were planted in the garden remained infected for several years, although finally the disease disappeared. He has suggested to me that the life cycle of *Sorosphaera Veronicae* is completed very rapidly, and that the spores before germination have to pass through the alimentary tract of a slug or other animal, in order to make them capable of germination; he has, however, obtained no evidence to support this suggestion.

Mention must also be made of a recent paper by P. M. Jones (5). He describes a new and very interesting organism which he has provisionally called *Plasmodiophora Tabaci*, isolated from tobacco plants which were affected by mosaic-like symptoms. It would be out of place here to discuss the relations of this remarkable form. There are several points in the life cycle which do not conform to the general plan found in all the other genera, and there seems some doubt whether it should be considered to be a member of the Plasmodiophorales. It seems more likely that it is intermediate between the Plasmodiophorales and the Lobosa, which supports the view that the

Plasmodiophorales must have had an origin independent of the Mycetozoa, and it is unfortunate that the word "mycetozoan" should have been used in the title of the paper. The important feature of the species is that it lives in leaves, and far from being affected by the chlorophyll itself causes mosiac-like disease of the host leaves.

It would appear that the substance which controlled the infection was specific in *Ligniera Junci*. There is little or no relation between the different genera in their reaction to a particular substance. In *Plasmodiophora Brassicae* calcium seems to be the inhibiting factor, while in *Spongospora subterranea* excess of lime favours the growth of the fungus. Lime does not seem to affect *Ligniera Junci*, although alkalinity inhibits the disease. The effect of light on *Plasmodiophora Brassicae* or *Spongospora subterranea* has not been recorded, but it is definitely toxic to *Ligniera Junci*. On the other hand *Sorosphaera Veronicae* only occurs in tissues which are exposed to light.

The genera of the Plasmodiophorales which have been mentioned are remarkably similar in their life histories, yet in their responses to certain physiological stimuli they show diametrically opposite reactions. It is clear, therefore, that the response of a particular fungus to a series of physiological factors is of absolutely no value in deducing the reactions of any other fungus even if the two closely resemble one another in their general life cycles.

My thanks are due to Professor R. R. Gates for helpful criticism, and also to Dr E. J. Schwartz, who has allowed me to record in several places unpublished observations which he has made.

Summary.

1. Inoculation experiments with *Ligniera Junci* have been carried out to determine whether the relative acidity or alkalinity of the soil has any effect upon the quantity of infection.

2. With water-plants grown in an aqueous culture medium, infection is obtained in solutions of *p*H 5 to *p*H 8, when the roots are protected from the light by covering them with silver sand.

3. When plants are grown in a similar culture medium without any protection for the roots, no infection is obtained even at the optimum *p*H value.

4. Infected plants grown in aqueous culture media without protection of the roots from light lose the fungus in less than three months.

5. A comparison is made between the response of *Ligniera Junci* to the acidity of the soil and that recorded in other genera. Related genera are found to have quite different responses.

REFERENCES.

(1) Atkins, W. R. G. Some factors affecting the hydrogen ion concentration of the soil, and its relation to plant distribution. Proc. Roy. Dublin Soc. xvi, pp. 369–427 (1922).
(2) —— Note on the occurrence of the finger and toe disease of turnips in relation to the hydrogen ion concentration of the soil. Proc. Roy. Dublin Soc. xvi, pp. 427–34 (1922).
(3) Blomfield, J. E. and Schwartz, E. J. Some observations on the tumours on *Veronica Chamaedrys* caused by *Sorosphaera Veronicae*. Ann. Bot. xxiv, pp. 35–43, Pl. 5 (1910).
(4) Cook, W. R. Ivimey. The genus Ligniera M. & T. Trans. Brit. Mycol. Soc. xi, pp. 196–213, Pls. VIII, IX (1926).
(5) Jones, P. M. Structure and cultural history of a mycetozoan found in tobacco plants with mosaic-like symptoms. Bot. Gaz. lxxxi, pp. 446–59, Pl. 34–37 (1926).
(6) Melhus, I. E., Rosenbaum, J. and Schultz, E. S. *Spongospora subterranea* and *Phoma tuberosa* on the Irish potato. Journ. Agric. Research, vii, pp. 213–53, Pl. 6–14 (1916).
(7) Schwartz, E. J. The Plasmodiophorales and their relation to the Mycetozoa and the Chytridineae. Ann. Bot. xxviii, pp. 227–49, Pl. 12 (1914).

STUDIES IN DISCOMYCETES. IV.

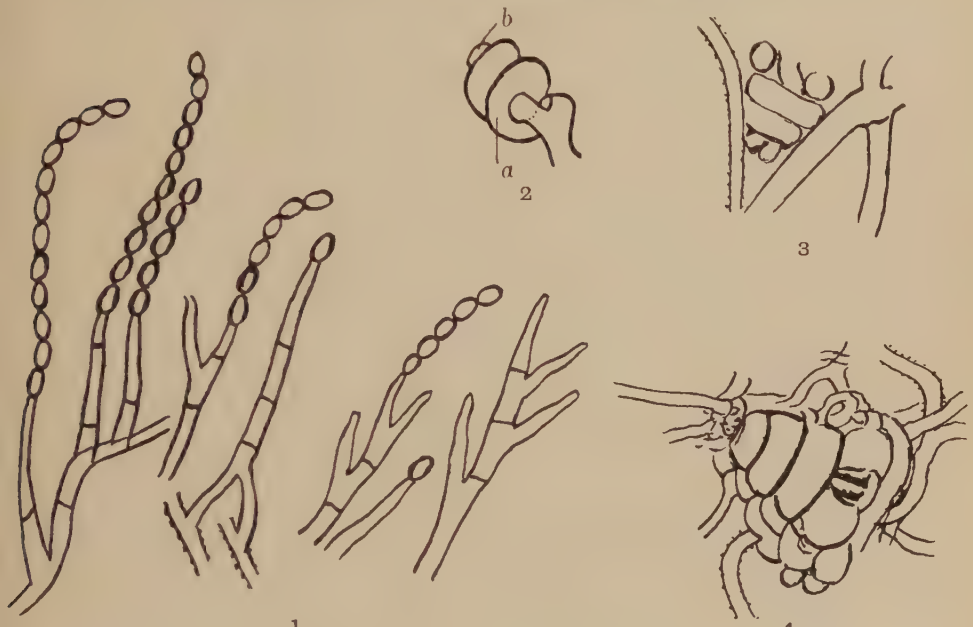
(With 4 Text-figs.)

By Jessie S. Bayliss Elliott, D.Sc. (Birmingham), B.Sc. (London).

Trichopeziza caesia (Pers.) Boud. This fungus, growing on a large chip of oak in my garden, showed conidia and primordial stages of the apothecia during August and September 1923. The conidia resembled those described and figured by Brefeld from cultures, being oval, unicellular and colourless 5–8 × 2·5–3μ (Brefeld's measured 5–8 × 3–4μ); they grew in very long streaming chains and developed basipetally, arising from simple or branched conidiophores (Fig. 1). The conidiophores appeared on the subiculum before the apothecia and continued to develop during early stages of apothecia formation.

For the examination of the primordia and early stages of apothecial development, microtome sections were made of material fixed in dilute ($\frac{1}{2}$ per cent.) chrom-acetic acid and stained with haematoxylin. An archicarp of the spiral type was present similar to that figured by Claussen (*Bot. Zeit.* lxiii, p. 1 (1905)) for *Ascodesmis nigricans* coiled round another hypha—presumably an antheridium (Fig. 2). Both hyphae were wider than ordinary vegetative hyphae and in one instance could be seen to have arisen as branches of a single bifurcating hypha (Fig. 2). No fusion was noted. A later stage showed the formation of a triangular shaped spiral of three or four turns (Figs. 3 and 4): this was followed by narrower hyphae from the vegetative hyphae around, growing up and surrounding the coiled primordial elements with a pseudoparenchymatous

sheath; thus a ball-like structure was formed looking very much like an ordinary cleistothecium of the *Sphaerotheca* type, from which branching and anastomosing hyphae began to extend outwards in all directions, thus giving the primordium the appearance of being enveloped in a thick layer of cotton wool. Meanwhile within this sheath, a hymenium of asci and paraphyses was formed; the details of development were not followed, owing to the very minute size of the elements concerned.



Trichopeziza caesia (Pers.) Boud.

Fig. 1. Conidia and conidiophores. × 800.
Fig. 2. Early stage in development of apothecium showing (*a*) coiled archicarp, and (*b*) antheridium. × 1500.
Fig. 3. Later stage drawn from microtomed material. × 1500.
Fig. 4. Young apothecium showing sterile hyphae beginning to form a sheath round an archicarp. Optical section. × 1500.

The hymenium becomes gradually exposed by the upward thrust of paraphyses bursting open the sheath and its woolly covering at the apex: the woolly covering persists for a time around the apothecium but sooner or later it dies away and a *Mollisia*-like apothecium is left seated on a subiculum composed of branching and anastomosing hyphae similar to the woolly sheath referred to above.

This fungus appeared again in the summer of 1924 on the same chip of wood, although no trace of it had been seen during

the winter of 1923–24. In July the conidial stage was very abundant and in August as soon as the piece of wood was placed in a little drier environment—in the open air but protected from rain—apothecia developed abundantly.

In Studies in Discomycetes III (*Trans. Brit. Mycol. Soc.* VII, p. 297, 1922) I referred to this fungus as *Mollisia caesia* (Fuckel) Sacc. thinking that "*Mollisia caesia* (Fuck.) Sacc. *Tapesia*" of Ramsbottom's list of British Discomycetes was synonymous with *Tapesia caesia* Fckl. as given by Massee; but it appears *Mollisia caesia* (Fuck.) Sacc. of the list is synonymous with *Niptera caesia* (Fuck.) (1871) and the fungus under consideration is really *Trichopeziza caesia* (Pers.) Boud. and is not included in Ramsbottom's list.

There seems to me however no reason why the fungus should not be retained in the genus *Tapesia*. Boudier includes in this genus species with apothecia of the *Mollisia* type which are growing on an abundant mycelium (subiculum) and, judging from the species he includes, this subiculum is usually brown but may be white, red or green. *Trichopeziza caesia* (Pers.) Boud. grows on a white subiculum and although the apothecium is surrounded by a sheath of anastomosing hairs in its immature condition, at maturity this disappears and the exterior is *Mollisia*-like; moreover the fungus while growing shows a course of development parallel to that of *Tapesia fusca* whose apothecia while immature possess a very similar hairy sheath disappearing at maturity.

Moreover, concerning the genus *Trichopeziza* in which he places the species under consideration Boudier says "beaucoup des espèces que je fais rentrer dans ce genre devront trouver place dans d'autres quand elles seront mieux connues."

Tapesia fusca (Pers.) Fuck. During several years I have watched the growth of the apothecia of this fungus which appears several times a year on a dead branch lying in my garden. The very young spherical apothecium before the hymenium is exposed is densely covered with anastomosing hairs, forming a woolly looking sheath; after the exposure of the hymenium this hairy sheath still persists around the excipulum. The hairs vary in colour from whitish to dark brown but they disappear eventually, leaving the apothecium looking like a typical *Mollisia* except that it is seated on a subiculum. The subiculum has always been well developed in material I have examined, though generally inconspicuous owing to its dark colour toning with that of the substratum—rotten oak wood—on which it was growing.

Humidity plays some part in the duration of the tomentose period of the apothecium, this being more prolonged if atmospheric conditions during the development are very damp. The

colour of the apothecia varied considerably, but although it included all ranges of honey-colour, grey or brown, apothecia were blue-grey when they had to a certain extent lost their hairy sheath and were still growing. The paraphyses were always well developed, about 2μ wide and aseptate. It will be seen that the development of this fungus is very similar to that described above for *Trichopeziza caesia*. In referring the fungus to its systematic position considerable difficulty was experienced because of its similarity at times to the closely allied *T. Rosae* (Pers.) Fuck., and *T. prunicola* Fuck.

Rehm though treating *T. prunicola* as a variety of *T. Rosae* remarks that he cannot see any essential difference between them and Massee treats both *T. prunicola* and *T. Rosae* as varieties of *T. fusca* and goes so far as to say that *T. Rosae* is scarcely to be considered a good variety of *T. fusca*.

A study of the descriptions of these species and an examination of material from the Kew Herbarium suggests that there is no essential difference between them. The tomentose exterior of *T. Rosae* and of *T. prunicola* seems the chief character which distinguishes them from *T. fusca* which is described as smooth.

Since the apothecia of *Tapesia fusca* show quite a prolonged tomentose period during their development, it seems to me not unreasonable to consider that *T. Rosae* and *T. prunicola* may be immature stages of *Tapesia fusca* the substrata, stems of *Rosa* and *Prunus* respectively, merely adding additional but not important distinction, for the Kew material includes specimens of *T. prunicola* from Sydow on *Spiraea* and *Calluna* and from Rehm on *Alnus*.

Tapesia lividofusca (Fr.) Rehm. In May 1921 I gathered this fungus at Borth. It is undoubtedly a *Tapesia* for a brown subiculum is present which is very dense where the apothecia are immature, though it becomes more scanty and even absent in the region of mature apothecia; further it is not unusual with other *Tapesia* spp. for the subiculum to disappear gradually, leaving only apothecia which are at that stage indistinguishable from those of the genus *Mollisia*.

It was first recorded for the country by Crossland (*Naturalist*, p. 5, 1904) under the name *Mollisia lividofusca* Gill. and is listed under that name by Ramsbottom. Although the spore measurements of my specimens approximate to those given by Rehm and Crossland they are invariably blunt, and not spindle-shaped or elliptic-fusiform as described respectively by these authors.

Rehm considers that *T. lividofusca* differs from *T. fusca* chiefly in that "ihr parenchymatisches, braunes Gehäuse bis zum Rande reicht, der auch niemals, besonders im trockenen Zustande, eingerollt ist." In my material the apothecia do show a rolling in of the margin; also the brown colour does not reach

to the rim, in fact the entire apothecium, not the hymenium only, appears very pale grey, or whitish yellow in contrast to the blue-grey appearance of *T. fusca* and moreover *T. lividofusca* seems altogether a more delicate structure than *T. fusca*.

Helotium lenticulare Fr. On examining material of this species, very kindly sent me by Miss Eyre (Aug. 1923) who found it growing on apple pulp, I was interested to find an apothecium in which the asci contained only four ascospores or sometimes fewer than four.

Pachyella depressa (Phill.) Boud. In May 1924 I received from Miss Eyre some very fine specimens of this fungus, which she had found growing on apple pulp. In these specimens the asci showed a very marked blue colour when treated with iodine.

Pachyella depressa (Phill.) Boud. var. ***pallida*** Rea. In May 1924 I received a collection of several apothecia which were referable to the species *Pachyella depressa*, except that they were pure white instead of amber brown, the only colour being a faint fuscous line round the margin. They were found growing on a log which had evidently been submerged for many months, perhaps years, in Barnt Green Reservoir (Worcestershire). A comparison with specimens of *P. depressa* from Porlock collected in the spring and autumn of 1920 indicated that the chief difference was the absence of colouring matter from the paraphyses and excipulum. Mr Rea kindly examined the specimen and agreed that it was a pale variety of *P. depressa* but considered it worthy of a varietal name—hence *P. depressa* var. *pallida*. The asci of this specimen do not give the blue reaction with iodine but I have gathered undoubted specimens of *P. depressa* which have not shown this reaction.

Hyalinia incarnata (Cooke) Boud. A specimen of this fungus was sent to me by Mr H. Bloom, May 1923. It was growing on a pine cone. Massee gives the substratum as pine leaves and remarks that the form and size of the spores were incorrectly described by Cooke and copied by Phillips and Saccardo. However, the spores of this specimen agreed with Cooke's description—linear, obtuse, hyaline, 10 × 1·5μ.

Other interesting Discomycetes I have received from Mr H. Bloom, are *Tapesia retincola* (Rabenh.) Karst. (May 1923) with spores slightly larger than either Rehm's or Crossland's measurements, being 18–23 × 2·5–3 instead of 15–18 × 2–2·5, also *Phialea bolaris* (Batsch) Quél. and *Plicaria Persoonii* (Cr.) Boud. (September 1924), all gathered at Mickleham, Surrey.

In conclusion I wish to express my indebtedness to Miss Wakefield for her kindness in consulting literature not available to me and to Miss Lorrain Smith and Mr J. Ramsbottom for advice on several fungi under criticism.

REVIEWS.

Iconographia Mycologica. By J. Bresadola. Milan: Società Botanica Italiana and Museo Civico di Storia Naturale di Trento. 8o.

All mycologists welcome the publication of this important work and rejoice in its being published under the auspices of the Società Botanica Italiana and the Museo Civico di Storia Naturale di Trento in celebration of the eightieth anniversary of the birth of the eminent Abbé The work will consist of one thousand plates with Latin diagnoses, including species of Hymenomycetae, Gasteromycetae and Discomycetae. Up to the present time two parts have been published of fifty plates each and it is proposed to complete the issue of the work within three years. The plates are excellent, giving both macroscopic and microscopic details, which will greatly facilitate the student in his identification of the species. From long experience I can say how helpful I have always found the beautiful plates Bresadola published in his *Fungi Tridentini*, with his accurate diagnoses, and I trust many of our members will subscribe to insure its completion. CARLETON REA.

The Microbiology of Cellulose, Hemicelluloses, Pectin and Gums. By A. C. Thaysen and H. J. Bunker. Pp. vii–363, tt. 9—five figs. in the text. Oxford: University Press. London: Humphrey Milford. 8o. 1927. 25*s.* net.

There is a wealth of mycological works now appearing presumably because there is a stabilisation of cost. The title of this book suggests that a gap has been filled in mycological literature, a gap which has proved somewhat troublesome to those who are lacking in chemical knowledge and moreover have not ready access to technical journals. It must be said however that the book is not satisfactory. The subject is admittedly difficult but the authors do not appear to have assimilated some at least of the information which they attempt to summarise, and some of the references given suffer from a failing that is becoming far too common in that a statement generally accepted is attributed to a recent author who happens to have mentioned it *en passant*. Over one hundred and thirty pages are occupied with a series of descriptions of bacteria and fungi which have been recorded as decomposing celluloses, etc. If the account is intended for reference it is neither in the right form nor complete enough; if not, a more general account would have been preferable. There is a suggestion of mere compilation, as if the authors have had no refining influence. There is a full synonymy of most of the species which in the form given is both unsatisfactory and misleading. The method of citation is often faulty. Time and again the authority is given in its wrong form, e.g. *Merulius lacrymans*, Wulfen.: Syn. *Boletus lacrymans*, Wulfen.; *Merulius lacrymans*, Schumacher. The method of double citation should be adopted or left alone. The recognised form is either *M. lacrymans* (Wulf.) Schum. or *M. lacrymans* Schum.

There is much information in the book that mycologists in general will welcome, but written in half the space it would have been of greater use.

J. R.

Enzymes: Properties, Distribution, Methods and Applications. By Selman A. Waksman and Wilbur C. Davison. 8o. pp. xii, 364 with 10 text-figures. London: Baillière, Tindall and Cox, 1926. 25*s.* net.

The importance of enzymes in biological processes is at least as obvious to mycologists as to other workers. In the present volume we have the whole subject of enzymes presented in a concise form with an indication of the original

sources from which more detailed information can be obtained. Perhaps this conciseness will be criticised by some reviewers, but there is much to be said for such an uncommon characteristic; and when the source of the information is accurately given anyone interested in a particular aspect of a problem has all he needs, for abstracts and summaries, excellent in their way, are only second best. A notable feature of the book is the full list of references, over thirteen hundred in number. The work is divided into four sections. The first deals with the properties of enzymes, the historical development of our knowledge of enzymes, the part they play, their chemistry and reactions and the factors influencing their reactions. The distribution of enzymes is then treated, the last chapter of this section dealing with the enzymes of micro-organisms including bacteria and fungi. The following section will be found of great assistance to research workers for it gives clear well-arranged instructions for the preparation and study of enzymes, their properties, the measurement of their activity and so on. The final section is one which will appeal to those who are called upon as mycologists to advise or comment upon the peculiar ways of fungi for the practical applications of enzyme industry are chiefly due to these. Here may be found descriptions of the use of enzymes in textile industries, in tanning, in the preparation of "beverages"—surely a painful subject to the authors, in fruit clarification, food preparation, poultry breeding, tobacco ripening and a few others. The book is attractively printed and bound and has a satisfactory index. J. R.

Die Pilze Mitteleuropas. By F. Kallenbach. Band I. Die Rohrlinge. (Boletaceae.) Lief. 3 and 4. Pp. 5–24, tt. 6. fol. Leipzig. Werner Klinkhardt. 1927. M. 10.

Two further fascicles of this work have appeared and are in every way up to the standard of the previous parts. As the text has now reached twenty-four pages we are able to gain a proper idea of the scope of the work for the whole is occupied with the very full description of seven of the species so far illustrated; a little more than two pages are devoted to the description of *B. rhodoxanthus* recorded by Mr Rea in the last number of the Transactions. The four additional coloured plates deal with *B. pseudosulphureus* Kallenb., which was described in 1923 from deciduous woods; *B. pulverulentus* Opat., which though not yet recorded for England, certainly occurs here; *B. rimosus* Vent. = *B. nigrescens* Roze and Richon; and *B. erythropus* Pers. non Fr. recorded in Rea's Basidiomycetae as *B. Queletii* var. *rubicundus*. The use of the name *B. erythropus* for different fungi has led to much confusion in the past. As Kallenbach realises, using it in the sense of Persoon is quite "illegal" according to the Brussels Code, but many of us are still not clear about the alternatives in fleshy fungi. If a reasonable nomenclature is adopted so that we can understand the results of so thorough a monograph we shall be better able to discuss the names having greater knowledge of the fungi. Two additional plates show photographs of five species and anatomical features of four.

J. R.

PROCEEDINGS, 1927

MEETING. UNIVERSITY COLLEGE, LONDON. *22nd January.*

W. Buddin and E. M. Wakefield. *Rhizoctonia Crocorum* (Pers.) DC. and *Helicobasidium purpureum* (Tul.) Pat.

R. C. Woodward. *Podosphaeria leucotricha*, the Apple Mildew.

K. Sampson. Anthracnose of Red Clover.

E. W. Mason. The naming of a dark-spored Hyphomycete.

J. Ramsbottom. Fragmenta Mycologica VI.

MEETING. UNIVERSITY COLLEGE, LONDON. *19th March.*

W. R. I. Cook. Influence of Environment on Infection of *Ligniera Junci.*

E. H. Ellis. Fungi in Japanese Carvings.

E. W. Fenton. Seed Mixtures and the Incidence of Fungal Diseases.

M. P. Hall. Zoning in Cultures of *Monilia fructigena.*

K. R. Mohendra. Varieties in *Sphaeropsis Malorum.*

J. Ramsbottom. Fragmenta Mycologica. VII.

SPRING FORAY FOR LONDON STUDENTS. WISLEY. *7th May.*

SPRING FORAY. MARLBOROUGH. *June 3rd—6th.*

LIST OF MEMBERS, 1927.

Honorary Members.

Bresadola, M. l'Abbé, Via Cr. Madruzzo 11, Trento, Italia. (1921.)
Lister, Miss Gulielma, F.L.S., 871, High Road, Leytonstone, Essex. (1903.) (1924.)
Rea, Mr Carleton, B.C.L., M.A., 6, Barbourne Terrace, Worcester. (1896.) (1918.)
Smith, Miss Annie Lorrain, F.L.S., 20, Talgarth Road, West Kensington, London, W. 14. (1899.) (1924.)
Thaxter, Professor Roland, 20, Divinity Avenue, Cambridge 38, Mass., U.S.A. (1920.)

Ordinary Members.

1. Aberdeen, The University Library. (1916.)
2. Adams, Rev. J. H., The Vicarage, Kidderminster. (1919.)
3. Adcock, Mr Archie, Upton Road, Norwich. (1921.)
4. Alcock, Mrs N. L., Royal Botanic Gardens, Edinburgh. (1919.)
5. Alexander, Rev. Philip J., C.J., St George's College, Weybridge, Surrey. (1921.)
6. Ali, Mr M. N., Forestry Department, H.E.H. The Nizam's Dominions, Hyderabad, India. (1926.)
7. Allen, Miss I. M., 4, Cunningham Avenue, St Albans, Herts. (1922.)
8. Ashby, Mr S. F., Imperial Bureau of Mycology, 17, Kew Green, Kew, Surrey. (1926.)
9. Bagchee, Mr K., Office of the Forest Botanist, Forest Research Institute and College, Dehra Dun, U.P., India. (1920.)
10. Baker, Mr Thomas, 191, Lees Road, Oldham. (1923.)
11. Barnes, Mr B., B.Sc., Birkbeck College, Bream's Buildings, Chancery Lane, London, E.C. 4. (1922.)
12. Barnett, Miss E. C., B.Sc., Botany Department, Marischal College, Aberdeen. (1921.)
13. Barr, Rev. Robert, T.D., M.A., The Manse, Neilston, Renfrewshire. (1918.)
14. Barrington, Dr F. J. F., University College Hospital, Medical School, University Street, London, W.C. 1. (1901.)
15. Bartlett, Mr A. W., M.A., B.Sc., Department of Botany, Armstrong College, Newcastle-on-Tyne. (1920.)
16. Bates, Mrs L. F., 82, Lordship Park, Stoke Newington, London, N. 16. (1921.)

17. Beaumont, Mr Albert, B.A., Seale-Hayne Agricultural College, Newton Abbot, Devon. (1924.)
18. Bewley, Mr W. F., D.Sc., Experimental and Research Station, Cheshunt, Herts. (1922.)
19. Biffen, Professor Sir Rowland H., M.A., F.R.S., 136, Huntingdon Road, Cambridge. (1899.)
20. Birmingham Natural History and Philosophical Society, c/o G. T. Calvert, Esq., Hon. Librarian, Avebury House, 55, Newhall Street, Birmingham. (1920.)
21. Bisby, Mr Guy R., Ph.D., Manitoba Agricultural College, Winnipeg, Canada. (1921.)
22. Blackman, Professor V. H., M.A., F.R.S., Imperial College of Science, South Kensington, London, S.W. 7. (1900.)
23. Blackwell, Miss Elsie M., M.Sc., Botanical Department, Royal Holloway College, Englefield Green, Surrey. (1917.)
24. Blagden, Mr C. O., 57, Earl's Court Square, London, S.W. 5. (1910.)
25. Bloom, Mr James Harvey, M.A., 123 Drakefield Road, Balham, London, S.W. 17. (1915.)
26. Bolas, Mr B. D., 60, Grove Park Terrace, Chiswick, London, W. 4. (1924.)
27. Borthwick, Professor A. W., D.Sc., Forestry Department, The University, Aberdeen. (1911.)
28. Boston, The Mycological Club, c/o Miss Jennie F. Conant, 26, Prospect Street, Melrose, Mass., U.S.A. (1906.)
29. Boyd, Mr D. A., St Clair, Caledonia Road, Saltcoats, N.B. (1906.)
30. Bracher, Miss Rose, M.Sc., Botanical Department, The University, Bristol. (1922.)
31. Braid, Professor K. W., B.A., B.Sc., West of Scotland Agricultural College, 6, Blythswood Square, Glasgow. (1922.)
32. Brazier, Mr E., Ty'n-y-gongl, Love Lane, Stourbridge. (1921.)
33. Breeze, Miss B. M., B.Sc., School of Agriculture, Cambridge. (1922.)
34. Brenchley, Mr G. H., B.A., Clare College, Cambridge. (1925.)
35. Brett, Miss M., M.Sc., Northern Polytechnic, Holloway Road, London, N. 7. (1921.)
36. Briant, Mr A. K., B.A., Shalbourne Mills, Hungerford, Berks. (1927.)
37. Brierley, Mr W. B., D.Sc., F.R.A.I., F.L.S., Institute of Plant Pathology, Rothamsted Experimental Station, Harpenden, Herts. (1919.)
38. Bright, Mr T. B., The Cove, Silverdale, Carnforth, Lancs.
39. British Museum, The Trustees of, Cromwell Road, South Kensington, London, S.W. 7. (1914.)
40. Briton-Jones, Professor H. R., Ph.D., D.I.C., A.R.C.S., Imperial College of Tropical Agriculture, St Augustine, Trinidad, B.W.I. (1923.)

41. Brittlebank, Mr C. C., Produce Offices, 607, Flinders Street, Melbourne, Victoria, Australia. (1921.)
42. Brooks, Mr F. T., M.A., The Botany School, Cambridge. (1907.)
43. Brown University, Library, East Side Station, Providence, R.I., U.S.A. (1920.)
44. Brown, Mr W., M.A., D.Sc., Imperial College of Science, South Kensington, London, S.W. 7. (1922.)
45. Bruxelles, Jardin Botanique de l'État, c/o M. P. van Aerdschot. (1911.)
46. Bryce, Mr G., D.Sc., Director, Rubber Research Institute, Kuala Lumpur, Federated Malay Straits. (1915.)
47. Buckley, Mr W. D., "Lynmouth," 2, Curzon Street, Slough. (1916.)
48. Buddin, Mr Walter, M.A., Laboratory of Plant Pathology, University of Reading, 7, Redlands Road, Reading. (1921.)
49. Buller, Professor A. H. R., D.Sc., Ph.D., F.R.S.C., University of Manitoba, Winnipeg, Canada. (1911.)
50. Bunker, Mr H. J., B.A., St Olave's, Churchfield Road, Poole, Dorset. (1925.)
51. Bunting, Mr R. H., F.L.S., Agricultural Department, Aburi, Gold Coast Colony, West Africa. (1921.)
52. Bunyard, Mr G. N., F.L.S., 25, Bower Mount Road, Maidstone, Kent. (1920.)
53. Burger, Dr O. F., Agricultural Experiment Station, Gainesville, Florida, U.S.A. (1925.)
54. Burr, Mr S., The Agriculture Department, The University, Leeds. (1924.)
55. Butcher, Mr R. W., B.Sc., Fisheries Research Station, Alresford, Hants. (1922.)
56. Butler, Mr E. J., C.I.E., D.Sc., F.R.S., M.B., F.L.S., Imperial Bureau of Mycology, 17, Kew Gardens, Kew, Surrey. (1920.)
57. Butler, Mr R. R., M.Sc., A.I.C., Chemical Department, Municipal Technical School, Plymouth, Devon. (1924.)
58. Cadman, Miss E. J., 5, Goldenacre Terrace, Edinburgh. (1921.)
59. Cambridge, The Botany School. (1920.)
60. Cape Town, Union of South Africa, The Mycologist (91410), Department of Agriculture. (1922.)
61. Carr, Professor J. W., M.A., University College, Nottingham. (1896.)
62. Carrothers, Mr E. N., 145, Stranmillis Road, Belfast, N. Ireland. (1925.)
63. Cartwright, Mr K. St G., B.A., New House Farm, Hughenden, Bucks. (1913.)
64. Castellani, Professor Aldo, C.M.G., M.D., 33, Harley Street, London, W. 1. (1922.)

65. Cayley, Miss Dorothy M., John Innes Horticultural Institute, Mostyn Road, Merton, Surrey. (1913.)
66. Chapman, Mr A. Chaston, F.R.S., F.I.C., Chemical Laboratories, 8, Duke Street, London, E.C. 3. (1926.)
67. Charles, Mr J. H. V., Biochemical Laboratory, Ardeer Factory, Nobel's Explosives Co., Ltd., Stevenston, Ayrshire. (1922.)
68. Chaudhuri, Mr H., M.Sc., Ph.D., University of the Punjab, Lahore, India. (1920.)
69. Cheal, Mr W. F., Kirton Agricultural Institute, Kirton, Nr Boston, Lincs. (1927.)
70. Cheel, Mr Edwin, Botanic Gardens, Sydney, New South Wales, Australia. (1919.)
71. Ciferri, Dr R., Director, Estacion Nacional Agronomica y Colegio de Agricultura, Moca, Dominican Republic, W.I. (1926.)
72. Cleland, Mr J. Burton, M.D., Professor of Pathology, University of Adelaide, South Australia. (1918.)
73. Clement, Mr E., 189, Upper Grosvenor Road, Tunbridge Wells, Kent. (1927.)
74. Collett, Mr R. Leslie, M.A., 12, Hereford Mansions, Bayswater, London, W. 2. (1921.)
75. Cook, Mr W. R. I., Ph.D., Priory Lodge, Newlands Park, Sydenham, London, S.E. 26. (1924.)
76. Cooper, Miss Charlotte A., California Lane, Bushey Heath, Herts. (1911.)
77. Copenhagen, Universitets-Bibliothek, c/o P. Haase & Son, Løvstraede 8, København K., Denmark. (1923.)
78. Cornell University, The Library, New York State College of Agriculture, Ithaca, N.Y., U.S.A. (1920.)
79. Corner, Mr E. J. H., Sidney Sussex College, Cambridge. (1924.)
80. Cory, Mr F. M., Botanical Department, The University, Bristol. (1926.)
81. Cotton, Mr Arthur D., F.L.S., Keeper, Herbarium, Royal Botanic Gardens, Kew, Surrey. (1902.)
82. Crawford, Miss J. M., The Vicarage, Lyford Road, Wandsworth Common, London, S.W. 18. (1926.)
83. Crow, Mr W. B., M.Sc., F.L.S., Botanical Department, University College, Cardiff. (1921.)
84. Cunningham, Mr G. H., Biological Laboratory, 71, Fairlie Terrace, Kilburn, Wellington, New Zealand. (1922.)
85. Curator, National Collection of Type Cultures, Lister Institute, Chelsea Gardens, London, S.W. 1. (1921.)
86. Curtis, Miss Kathleen M., M.A., D.Sc., D.I.C., F.L.S., Mycologist, Biological Department, Cawthron Institute of Scientific Research, Nelson, New Zealand. (1917.)
87. Cutting, Mr E. M., M.A., F.L.S., Botanical Department, University College, Gower Street, London, W.C. 1. (1920.)

88. Darbishire, Professor O. V., B.A., Ph.D., F.L.S., The University, Bristol. (1913.)
89. Das, Mr Kedarnath, C.I.E., M.D., Principal, Carmichael Medical College, 1, Belgachia Road, Calcutta, India. (1922.)
90. Davies, Mr D. W., B.Sc., Adviser in Mycology, Agricultural Buildings, University College of Wales, Aberystwyth. (1923.)
91. Davis, Mr J. Jefferson, B.S., M.D., University of Wisconsin, Madison, Wis., U.S.A. (1921.)
92. Day, Mr E. Metcalfe, Rowan Cottage, Minchinhampton, Glos. (1921.)
93. Deighton, Mr F. C., B.A., Mycologist, Department of Lands and Forests, Freetown, Sierra Leone, West Africa. (1925.)
94. Dickinson, Mr S., 3, The Warren, Lillington, Leamington Spa. (1921.)
95. Dickson, Professor B. T., B.A., Ph.D., Macdonald College, St Anne de Bellevue, Quebec, Canada. (1923.)
96. Diggle, Major P. G. W., c/o National Bank of Egypt, 6, King William Street, London, E.C. (1926.)
97. Dodge, Dr Carroll W., Farlow Herbarium, 20, Divinity Avenue, Cambridge, 38, Mass., U.S.A. (1926.)
98. Dowson, Mr W. J., M.A., F.L.S., Royal Horticultural Society's Gardens, Wisley, Ripley, Surrey. (1920.)
99. Doyle, Professor J., M.Sc., University College, Dublin. (1925.)
100. Duke, Miss M. M., B.Sc., Herbarium, Royal Botanic Gardens, Kew, Surrey. (1924.)
101. Edwards, Mr W. H., Curator, The Museum, Birmingham. (1896.)
102. Elliot, Rev. E. A., Dunstall Vicarage, Burton-on-Trent. (1923.)
103. Elliott, Mr W. T., D.D.S., L.D.S., F.L.S., F.Z.S., Arden Grange, Tanworth-in-Arden, Warwickshire. (1913.)
104. Elliott, Mrs J. S. Bayliss, D.Sc. (B'ham), B.Sc. (Lond.), Arden Grange, Tanworth-in-Arden, Warwickshire. (1911.)
105. Ellis, Mr David, D.Sc., Ph.D., F.R.S.E., Royal Technical College. (1923.)
106. Ellis, Mr E. H., British Museum (Nat. Hist.), Cromwell Road, London, S.W. 7. (1924.)
107. Ellis, Mr Holmes, F.R.M.S., 23, Townley Street, Colne, Lancs. (1927.)
108. Engledow, Mr F. L., M.A., School of Agriculture, Cambridge. (1922.)
109. Essex Field Club, c/o Mr Percy Thompson, F.L.S., Essex Museum of Natural History, Romford Road, Stratford, London, E. 15. (1919.)
110. Exeter, Librarian, University College of the South-West of England. (1926.)

111. Eyre, Miss J. C., Maitlands Cottage, Ipplepen, Newton Abbot, Devon. (1915.)
112. Fenton, Mr E. W., M.A., B.Sc., F.L.S., Botanical Department, Seale Hayne Agricultural College, Newton Abbot, Devon. (1920.)
113. Finlayson, Mr Raymond A., F.L.S., Official Seed Testing Station, Huntingdon Road, Cambridge. (1910.)
114. Fry, Miss E. J., "Hazelhurst," Pear Tree Avenue, Bitterne, Southampton. (1923.)
115. Gadd, Mr C. H., D.Sc., Tea Research Institute, Nuwara Eliya, Ceylon. (1921.)
116. Gardner, Capt. Frederic, c/o Lloyd's Bank, Jersey, C.I. (1898.)
117. Garside, Mr S., M.Sc., F.L.S., Botanical Department, Bedford College, Regent's Park, London, N.W. 1. (1922.)
118. Gates, Professor R. R., B.Sc., Ph.D., F.L.S., King's College, Strand, London, W.C. (1921.)
119. Gilbert, M. E., Docteur en Pharmacie, 6, Rue de Laos, Paris (15e), France. (1924.)
120. Gilbert, Dr E. M., Botanical Department, University of Wisconsin, Madison, Wis., U.S.A. (1922.)
121. Gilchrist, Miss Grace G., B.Sc., Botanical Department, The University, Bristol. (1921.)
122. Gorman, Mr M. J., A.R.C.Sc.I., College of Science, Upper Merrion Street, Dublin. (1925.)
123. Gossling, Mrs W. L., 20, Carlton Hill, London, N.W. 8. (1922.)
124. Gough, Mr G. C., B.Sc., A.R.C.S., Ministry of Agriculture, Birmingham. (1923.)
125. Gould, Mr F. G., Elmhurst, Church Hill, Loughton, Essex. (1918.)
126. Green, Col. C. Theodore, A.M.S., M.R.C.S., L.R.C.P., F.L.S., 31, Shrewsbury Road, Birkenhead. (1901.)
127. Green, Miss E., 9, Brunswick Square, London, W.C. (1925.)
128. Green, Mr E. Ernest, F.Z.S., F.E.S., Way's End, Camberley, Surrey. (1917.)
129. Grey, Mrs O., F.Z.S., 90, Charing Cross Road, London, W.C. 2. (1926.)
130. Grinling, Mr C. H., B.A., 71, Rectory Place, Woolwich, London, S.E. 18. (1913.)
131. Gunter, Mr Thomas J., 4, Alexandra Road, London, N. 4. (1926.)
132. Gwynne-Vaughan, Professor Dame Helen, D.Sc., LL.D., F.L.S., 93, Bedford Court Mansions, London, W.C. 1. (1906.)
133. Haas, Mr P., D.Sc., Ph.D., F.C.S., University College, Gower Street, London, W.C. 1. (1921.)
134. Hanna, Mr W. F., M.Sc., University of Alberta, Edmonton, Alberta, Canada. (1925.)

135. Hansford, Mr C. G., M.A., Mycologist, Department of Agriculture, Kampala, Uganda. (1921.)
136. Harvard University, The Library, Cambridge, Mass., U.S.A. (1923.)
137. Hare, Mr J. G., Molteno Institute of Parasitology, Cambridge. (1924.)
138. Harris, Mr R. V., B.Sc., Horticultural Research Station, East Malling, Kent. (1924.)
139. Harvey, Mrs Cecily D., Barwick-in-Elmet Rectory, near Leeds. (1910.)
140. Hastings, Mr Somerville, M.S., F.R.C.S., 43, Devonshire Street, Portland Place, London, W. 1. (1913.)
141. Hemmi, Dr Takewo, Phytopathological Institute, Department of Agriculture, Kyoto Imperial University, Kyoto, Japan. (1923.)
142. Hildyard, Mr F. W., 14, Lambridge, Bath. (1913.)
143. Hiley, Mr Wilfred E., M.A., F.L.S., Research Institute, School of Forestry, Oxford. (1913.)
144. Hoare, Mr A. H., 111, Blenheim Gardens, Wallington, Surrey. (1922.)
145. Hoggan, Miss I. A., Department of Plant Pathology, University of Wisconsin, Madison, Wis., U.S.A. (1923.)
146. Holden, Dr H. S., F.L.S., Botanical Department, University College, Nottingham. (1923.)
147. Honolulu, The Library, Experiment Station, S.P.A., Box 411, Hawaii. (1920.)
148. Horne, Mr A. S., D.Sc., F.L.S., F.G.S., Botanical Department, Imperial College of Science, South Kensington, London, S.W. 7. (1921.)
149. Howard, Mr H. J., F.R.M.S., "Lingfield," 6, College Road, Norwich. (1918.)
150. Howarth, Mr W. O., M.Sc., Botanical Department, The University, Manchester. (1927.)
151. Hughes, Mr G. C., Chesterton, Bicester, Oxon. (1898.)
152. Hughes, Mr J. S., 67, Woodstock Road, Oxford. (1927.)
153. Humphrey, Mr C. J., Mycologist and Plant Pathologist, Bureau of Science, Manila, Philippine Islands. (1921.)
154. Hurrell, Mr H. E., 25, Regent Street, Great Yarmouth. (1921.)
155. Hyde, Mr H. A., M.A., F.L.S., National Museum of Wales, Cardiff. (1924.)
156. Imperial College of Tropical Agriculture, Trinidad, B.W.I. (1921.)
157. Iowa, The Library, State University of Iowa, Iowa City, U.S.A. (1923.)
158. Iowa State College, Library, Ames, Iowa, U.S.A. (1927.)
159. Issatchenko, Professor B. L., Directeur du Jardin Botanique, Petrograd. (1923.)

160. Jaczewski, Professor Arthur de, Director, Institute of Mycology and Phytopathology, Perspective Anglaise 29, Petrograd, Russia. (1922.)
161. John Innes Horticultural Institute, Mostyn Road, Merton, Surrey. (1924.)
162. Johnson, Mr J. W. Haigh, M.Sc., F.I.C., F.L.S., Walton, near Wakefield. (1919.)
163. Johnstone, Miss K. H., B.A., All Saints' Vicarage, Cheltenham, Glos. (1927.)
164. Johnstone, Mr R. B., 3, Oswald Gardens, Scotstounhill, Glasgow. (1908.)
165. Jones, Mr G. H., M.A., Department of Agriculture, Ibadan, South Nigeria. (1922.)
166. Jones, Mr Robert Fowler, Trinity House, Denton Road, Ilkley, Yorks. (1918.)
167. Jørstad, Mr Ivar, Statsmykolog, Botanisk Museum, Christiania, Norway. (1923.)
168. Kavina, Professor Dr Karel, Professor of Botany, Havlickovy-sady 58, Praha-Kral. Vinohrady (Prague), Czechoslovakia. (1926.)
169. Keef, Miss Phoebe, Mortimer Lodge, Wimbledon Park, London, S.W. 17. (1921.)
170. Keilin, Dr D., Molteno Institute of Parasitology, Cambridge. (1922.)
171. Keissler, Dr Karl, Direktor d. Botanischen Abteilung, Naturhistorisches Museum, Burgring 7, Wien 1/1, Austria (1924.)
172. Kelly, Dr Howard A., 1418, Eutaw Place, Baltimore, Md., U.S.A. (1921.)
173. Kendall, Miss Olwen, 9, Lordship Park, Stoke Newington, London, N. 16. (1921.)
174. Kew, The Library, Royal Botanic Gardens. (1921.)
175. Kidd, Mrs Franklin, B.A., The Botany School, Cambridge. (1919.)
176. Kirby, Mr E. E., B.A., Grafton House, Oxford Street, Norwich. (1924.)
177. Klika, Mr Bohumil, Hálkova 37, Prague, Vrsovice 553, Czechoslovakia. (1926.)
178. Knight, Mr H. H., M.A., The Lodge, All Saints' Villas, Cheltenham. (1914.)
179. Knowles, Miss M. C., M.R.I.A., Natural History Museum, Dublin. (1925.)
180. Krieger, Mr L. C. C., 2114, N. Calvert Street, Baltimore, Md., U.S.A. (1921.)
181. Kulkarni, Mr G. S., M.Ag., Cotton Research Laboratory, Dharwar, India. (1922.)

182. Lampitt, Mr L. H., D.Sc., F.I.C., Thornlea, Mount Park, Harrow, Middlesex. (1925.)
183. Latter, Miss Joan, Botanical Department, King's College, Strand, London, W.C. 2. (1923.)
184. Leicester, The Museum, City of Leicester. (1923.)
185. Lewis, Professor F. J., D.Sc., University of Alberta, Edmonton, Alberta, Canada. (1924.)
186. Line, Mr James, M.A., School of Agriculture, Cambridge. (1921.)
187. Linnean Society, The, Burlington House, Piccadilly, London, W. 1. (1919.)
188. Lloyd Library, The, Cincinnati, Ohio, U.S.A.
189. Lowndes, Mr A. G., M.A., Marlborough College, Marlborough, Wilts. (1922.)
190. MacCallum, Mrs B. D., M.A., D.Sc., F.L.S., c/o Professor MacCallum, Department of Pathology, University of Melbourne, Australia. (1921.)
191. Mackenzie, Miss A. D., Research Station, East Malling, Kent. (1921.)
192. Mackenzie, Mr D., . (1900.)
193. Madras University Library, Madras, South India. (1925.)
194. Maire, M. René, D.Sc., Professeur à la Faculté des Sciences de l'Université, Algers, Algeria, N. Africa. (1907.)
195. Maltby, Mr G. C., 14, Northwick Road, Evesham. (1923.)
196. Marriott, Mr St John, 37, Owenite Street, Abbey Wood, London, S.E. 2. (1920.)
197. Marsh, Mr R. W., M.A., Research Station, Long Ashton, Bristol. (1923.)
198. Martyn, Mr E. B., B.A., 27, Belgrave Road, London, S.W. 1. (1927.)
199. Mason, Mr E. W., M.A., M.Sc., Imperial Bureau of Mycology, 17, Kew Green, Kew, Surrey. (1921.)
200. Mason, Mrs E. W., Suffield House, Paradise Road, Richmond, Surrey. (1922.)
201. Mason, Mr F. A., F.R.M.S., M.S.P.A., 29, Frankland Terrace, Leeds. (1912.)
202. Matthews, Mr J. R., M.A., F.L.S., Royal Botanic Gardens, Edinburgh. (1921.)
203. Mehta, Professor K. C., Ph.D., Department of Biology, Agra College, Agra, U.P., India. (1921.)
204. Melvill, Mr J. Cosmo, M.A., D.Sc., F.L.S., Meole Brace Hall, Shrewsbury. (1922.)
205. Menzies, Mr James, 117, Scott Street, Perth. (1917.)
206. Metcalfe, Mr C. R., The Hirsel, Broadstone, Dorset. (1926.)
207. Meulenhoff, Dr J. S., President, Dutch Mycological Society, Diezerstraat, Zwolle, Holland. (1921.)

208. Michigan Agricultural College Library, East Lansing, Michigan, U.S.A. (1924.)
209. Millard, Mr W. A., B.Sc., The Agriculture Department, The University, Leeds. (1924.)
210. Missouri, The Botanical Garden, St Louis, Mo., U.S.A. (1902.)
211. Miyabe, Dr Kingo, Professor of Botany, Hokkaido Imperial University, Sapporo, Japan. (1919.)
212. Mohendra, Mr K. R., Botanical Department, Imperial College of Science, South Kensington, London, S.W. 7. (1927.)
213. Montague, Mrs A., Penton, Crediton, N. Devon. (1898.)
214. Moore, Miss E. S., Ph.D., c/o the Secretary, Department of Agriculture, P.O. Box 994, Pretoria, South Africa. (1923.)
215. Moore, Mr W. C., M.A., Ministry of Agriculture, Pathological Laboratory, Milton Road, Harpenden, Herts. (1922.)
216. Morris, Mr L. E., The Shirley Institute, Didsbury, Manchester. (1924.)
217. Moss, Professor C. E., The University, P.O. Box 1176, Johannesburg, South Africa. (1923.)
218. Mottram, Miss W. E., B.Sc., Horton Lane, Epsom, Surrey. (1925.)
219. Mundkur, Mr B. B., M.A., Cotton Research Laboratory, Government Farm, Dharwar, India. (1924.)
220. Murphy, Mr P. A., Sc.D., A.R.C.Sc.I., M.R.I.A., Plant Diseases Division, College of Science, Upper Merrion Street, Dublin. (1924.)
221. Murray, Mr G. H., F.E.S., Papuan Government Service, Port Moresby, Papua, British New Guinea. (1921.)
222. Murrell, Major Percy J., O.B.E., F.R.M.S., "Littlecroft," Orpington, Kent. (1923.)
223. Muskett, Mr A. E., B.Sc., A.R.C.S., Queen's University, Belfast, North Ireland. (1923.)
224. McDonald, Mr J., B.Sc., Mycologist, Department of Agriculture, Box 323, Nairobi, Kenya Colony, East Africa. (1923.)
225. McDougall, Professor W. B., University of Illinois, Urbana, Ill., U.S.A. (1921.)
226. McFarland, Dr Frank T., Department of Botany, University of Kentucky, Lexington, Ky., U.S.A. (1924.)
227. McLean, Professor R. C., M.A., D.Sc., F.L.S., Botany School, University College, Cardiff. (1922.)
228. McLennan, Dr Ethel I., Botanical Department, Melbourne University, Carlton, Victoria, Australia. (1926.)
229. Nagpur, The Mycologist to the Government, C.P., India. (1924.)
230. Nattrass, Mr R. M., B.Sc. (Agric.), Research Station, Long Ashton, Bristol. (1925.)
231. Nebraska, The Library, University of, Lincoln, Nebr., U.S.A. (1924.)

232. Nederlandsche Mycologische Vereeniging, c/o H. A. A. van der Lek, Zoomweg 10, Wageningen, Holland. (1920.)
233. Newcastle-upon-Tyne, Literary and Philosophical Society, c/o Mr H. Richardson, Librarian. (1902.)
234. New York Botanical Garden, Bronx Park, New York, U.S.A. (1904.)
235. Nicholson, Mr W. E., F.L.S., 50, St Anne's Crescent, Lewes. (1913.)
236. Noel, Miss E. F., F.L.S., 37, Moscow Court, Queen's Road, London, W. 2. (1913.)
237. Norman, Mr L. Stafford, Korigeni Estate, Luchenza P.O., Nyasaland. (1927.)
238. North Carolina, Library, University of, Chapel Hill, North Carolina, U.S.A. (1920.)
239. Nursery and Market Garden Industries' Development Society, Ltd., Experimental and Research Station, Cheshunt, Herts. (1922.)
240. Nutman, Mr F. J., B.Sc., A.R.C.S., Imperial Forestry Institute, Oxford. (1926.)
241. O'Connor, Mr P., B.Sc., A.R.C.Sc.I., College of Science, Upper Merrion Street, Dublin. (1925.)
242. Ogilvie, Mr L., M.A., M.Sc., Department of Agriculture, Agricultural Station, Paget East, Bermuda. (1922.)
243. Oke, Mr Alfred William, B.A., F.G.S., F.L.S., 32, Denmark Road, Hove, Sussex. (1908.)
244. Oldham, Mr C. H., Ivy Dene, Chandler's Ford, Southampton. (1923.)
245. Ontario Agricultural College, Library, Guelph, Ontario, Canada. (1920.)
246. Osborn, Professor T. G. B., M.Sc., Adelaide University, Adelaide, South Australia. (1910.)
247. Ottawa, Ontario, Canada, The Library, Geological Survey. (1926.)
248. Overeem, Dr C. van, Mycologisches Museum, Weesp, Holland. (1920.)
249. Page, Miss W. M., B.Sc., 19, Ledam Buildings, Bourne Estate, Holborn, London, E.C. 1. (1921.)
250. Pan, Mr T. C., M.B., Ch.B., Red Cross Hospital, 263 Avenue Haig, Shanghai, China. (1925.)
251. Parke Davis & Co., Librarian, Research Department, Detroit, Michigan, U.S.A. (1920.)
252. Paul, The Very Rev. David, D.D., LL.D., 53, Fountainhall Road, Edinburgh. (1899.)
253. Paulson, Mr Robert, F.L.S., F.R.M.S., Glenroy, Cecil Park, Pinner, Middlesex. (1918.)
254. Peacock, Dr H. G., The Lawn, Torquay. (1896.)

255. Pearson, Mr Arthur A., F.L.S., 59, Southwark Street, London, S.E. 1. (1911.)
256. Peklo, Dr Jaroslav, Professor of Applied Botany, Bohemian Technical University, Charles Square, Prague II, Czechoslovakia. (1924.)
257. Perthshire Society of Natural Science, c/o Mr James Winter (Hon. Treasurer), 35, George Street, Perth. (1919.)
258. Petch, Mr T., B.A., B.Sc., Tea Research Institute, Nuwara Eliya, Ceylon. (1911.)
259. Pethybridge, Mr G. H., Ph.D., B.Sc., Ministry of Agriculture, Pathological Laboratory, Milton Road, Harpenden, Herts. (1919.)
260. Philadelphia, The Academy of Natural Sciences of Philadelphia, Logan Square, Phila., U.S.A. (1925.)
261. Phillips, Dr H. H., 6, St John's Road, Penge, London, S.E. 10. (1923.)
262. Phillips, Mr F. J., Research Officer, Forest Research Station, Deepwalls, Knysna, South Africa. (1921.)
263. Ping, Mr A. Wentworth, M.A., "St Olave's," Clifton, York. (1926.)
264. Plowright, Mr C. T. M., B.A., M.B., King Street, King's Lynn. (1901.)
265. Potter, Rev. M. C., Sc.D., M.A., F.L.S., Corley Croft, New Milton, Hants. (1896.)
266. Povah, Professor A. H., 9, Fisk Hall, Northwestern University, Evanston, Ill., U.S.A. (1924.)
267. Preston, Mr N. C., B.Sc., Harper Adams Agricultural College, Newport, Salop. (1920.)
268. Pretoria, South Africa, The Chief, Division of Botany (91403), Department of Agriculture. (1922.)
269. Priestley, Professor J. H., D.S.O., B.Sc., F.L.S., Botanical Department, The University, Leeds. (1912.)
270. Proefstation voor Thee, Department van Landbouw, Buitenzorg, Java. (1926.)
271. Pusa, Imperial Mycologist, Imperial Agricultural Research Institute, Pusa, Bihar, India. (1921.)
272. Ramsbottom, Mr J., O.B.E., M.A., F.L.S., British Museum, Cromwell Road, South Kensington, London, S.W. 7. (1910.)
273. Rayner, Mr J. F., Swaythling, Southampton. (1902.)
274. Rayner, Miss M. Cheveley, D.Sc., Bedford College for Women, Regent's Park, London, N.W. 1. (1921.)
275. Rea, Mrs E. A., 6, Barbourne Terrace, Worcester. (1896.)
276. Rea, Miss M. W., M.Sc., Salem House, Sydenham, Belfast, Ireland. (1920.)
277. Rea, Miss Violet, 6, Barbourne Terrace, Worcester. (1921.)

278. Reichert, Dr Israel, Plant Pathologist, Palestine Zionist Executive Agricultural Experiment Station, Tel-Aviv, Palestine. (1924.)
279. Rhind, Mr Donald, B.Sc., Mycologist, Department of Agriculture, Agricultural College, Mandalay, Burma. (1922.)
280. Rhodes, Miss Mabel, Lister Institute, Chelsea Gardens, London, S.W. 1. (1921.)
281. Richards, Mr R. M., M.B.E., A.R.C.S., F.L.S., The Laboratory, Caledonia Estate, Province Wellesley, Straits Settlements. (1915.)
282. Roberts, Mrs A. W. Rymer, The End House, Fulbrook Road, Cambridge. (1920.)
283. Robinson, Professor Wilfred, Stoneleigh, Caradog Road, Aberystwyth, N. Wales. (1923.)
284. Robson, Mr R., M.Sc., F.Z.S., East Hammingfield, Chelmsford, Essex. (1914.)
285. Rolfe, Mr F. W., Colonial and Indian Collections, Imperial Institute, London, S.W. 7. (1923.)
286. Rolfe, Mr R. T., F.I.C., 76, Spenser Road, Bedford. (1924.)
287. Roper, Miss Ida M., F.L.S., 4, Woodfield Road, Redland, Bristol. (1921.)
288. Rothamsted Experimental Station, Department of Mycology, Harpenden, Herts. (1923.)
289. Rushton, Mr W., A.R.C.S., D.I.C., St Thomas's Hospital Medical School, Albert Embankment, London, S.E. 1. (1914.)
290. Rutgers College and State University of New Jersey, Library, New Brunswick, New Jersey, U.S.A. (1922.)
291. Ryan, Mr G. M., F.L.S., 35, Ladbroke Gardens, London, W. 11. (1923.)
292. St Paul, Minnesota, U.S.A., The Library, Department of Agriculture, University Farm. (1920.)
293. Salisbury, Mr E. J., D.Sc., F.L.S., Botanical Department, University College, Gower Street, London, W.C. 1. (1921.)
294. Salmon, Professor E. S., F.L.S., South-Eastern Agricultural College, Wye, Kent. (1922.)
295. Sampson, Miss K., B.Sc., University College, Aberystwyth, North Wales. (1920.)
296. Samuel, Mr Geoffrey, The University of Adelaide, South Australia. (1923.)
297. Sanderson, Mr A. R., F.L.S., 163, Ampang Road, Kuala Lumpur, Federated Malay States. (1921.)
298. Schinz, Professor Dr, Botanical Garden and Museum, Zurich, Switzerland. (1921.)
299. Science Library, South Kensington, London, S.W. 7. (1924.)

300. Scott, Mr W. W., 23, Wood Lane, Highgate, London, N. 6. (1922.)
301. Searle, Mr G. Odell, B.Sc. (Agric.), Research Botanist, Linen Industry Research Association, Glenmore House, Lambeg, Lisburn, Ireland. (1920.)
302. Sharpe, Mr C. J., Brambleside, Manor Road, Sidcup. (1905.)
303. Sharples, Mr A., A.R.C.S., D.I.C., Mycologist, Department of Agriculture, Kuala Lumpur, Federated Malay States. (1924.)
304. Shaw, Mr F. J. F., D.Sc., A.R.C.S., F.L.S., Imperial Agricultural Research Institute, Pusa, Bihar, India. (1920.)
305. Small, Mr W., M.B.E., M.A., Ph.D., B.Sc., Mycologist, Royal Botanic Gardens, Peradeniya, Ceylon. (1915.)
306. Smith, Mr Alexander, Cruikshank Botanic Gardens, Old Aberdeen. (1924.)
307. Smith, Mr F. E. V., B.Sc., Microbiologist, Department of Agriculture, Jamaica, B.W.I. (1922.)
308. Smith, Miss K. E., 64, Coton Road, Nuneaton. (1913.)
309. Smith, Professor Noel J. G., Ph.D., B.Sc., Botany Department, Rhodes University, Grahamstown, S. Africa. (1924.)
310. Smith, Miss S. Somerford, 6, Barbourne Terrace, Worcester. (1923.)
311. Solberg, Miss Louise, Kobbervik Drammen, Norway. (1923.)
312. South London Botanical Institute, Tulse Hill, Herne Hill, London, S.E. 24. (1921.)
313. Southwell, Mr Herbert, A.R.C.S., 158, Lincoln Road, Peterborough. (1923.)
314. Stakman, Professor E. C., University of Minnesota, Minneapolis, Minn., U.S.A. (1922.)
315. Stansfield, Miss O. P., M.Sc., 70, Northcourt Avenue, Reading. (1922.)
316. Statham, Miss E. M., 262, Burrage Road, Woolwich, London, S.E. 18. (1926.)
317. Stationery Office, H.M., Superintendent of Publications, Book Dept., Westminster, S.W. 1. (2 subscriptions.) (1920.)
318. Stelfox, Mrs, "Mayfield," Clareville Road, Rathgar, Dublin. (1925.)
319. Stirrup, Mr H. H., M.Sc., Midland Agricultural College, Sutton Bonington, Loughborough. (1922.)
320. Storey, Mr H. H., B.A., Natal Herbarium, Durban, South Africa. (1922.)
321. Sutherland, Mr G. K., M.A., D.Sc., F.L.S., 110, Brackenbury Road, Moor Park, Preston. (1914.)
322. Swansea Field Naturalists' Society, c/o Mr Alan Stuart, M.Sc., University College, Singleton, Swansea, South Wales. (1924.)

323. Swanton, Mr E. W., A.L.S., Educational Museum, Haslemere, Surrey. (1899.)
324. Swedish Academy of Sciences, Royal, Stockholm, Sweden. (1919.)
325. Sydney, Australia, The Librarian, University of. (1922.)
326. Tabor, Mr R. J., B.Sc., F.L.S., Botanical Department, Imperial College of Science, South Kensington, London, S.W. 7. (1914.)
327. Tagg, Mr H. F., F.L.S., Royal Botanic Garden, Edinburgh. (1921.)
328. Tandy, Mr Geoffrey, B.A., F.L.S., Department of Botany, British Museum, Cromwell Road, South Kensington, London, S.W. 7. (1925.)
329. Taylor, Miss B. K., 98, Cheyne Walk, Chelsea, London, S.W. 3. (1910.)
330. Tennessee, University of, Agricultural Experiment Station, Library, Knoxville, Tennessee, U.S.A. (1926.)
331. Thompson, Miss N. L., B.Sc., 4, Burton Court, London, S.W. 3. (1926.)
332. Tomkins, Mr R. G., B.A., Trinity College, Cambridge. (1925.)
333. United States Department of Agriculture, c/o W. Wesley & Son, 28, Essex Street, Strand, London, W.C. 2. (1907.)
334. Vines, Professor S. H., M.A., D.Sc., F.R.S., F.L.S., Langstone, Exmouth, Devon. (1915.)
335. Wadham, Professor S. M., M.A., Department of Agriculture, The University, Melbourne, Victoria, Australia. (1922.)
336. Wager, Mr H., D.Sc., F.R.S., F.L.S., 4, Bank View, Chapel Allerton, Leeds. (1896.)
337. Wakefield, Miss E. M., M.A., F.L.S., Herbarium, Royal Botanic Gardens, Kew. (1911.)
338. Waldie, Mr J. S. L., B.Sc., C.D.A., Imperial Forestry Institute, Oxford. (1925.)
339. Wales, University College of, Librarian, Botanical Department, Aberystwyth, North Wales. (1927.)
340. Wallis, Mr A., Westacre, Station Road, Kettering. (1921.)
341. Ward, Mr F. S., Department of Agriculture, Kuala Lumpur, Federated Malay States. (1925.)
342. Ware, Mr W. M., M.Sc., South-Eastern Agricultural College, Wye, Kent. (1924.)
343. Washington, Library, State College of Washington, Pullman, Wash., U.S.A. (1924.)
344. Watson, Mr W., D.Sc., A.L.S., Taunton School, Taunton. (1923.)
345. Welsford, Miss E. J., Sefton, Jenner Road, Guilford. (1924.)
346. Westerdijk, Professor Johanna, Javalaan 4, Baarn, Holland. (1923.)

347. Weston, Mr W. A. R. Dillon, B.A., School of Agriculture, Cambridge. (1923.)
348. Whetzel, Professor H. H., M.A., New York State College of Agriculture, Cornell University, Ithaca, N.Y., U.S.A. (1914.)
349. Whitaker, Mr F. Owen, 45, Elmdene Road, Plumstead, London, S.E. 18. (1921.)
350. Whitehead, Mr T., Ph.D., A.R.C.S., University College of North Wales, Bangor. (1920.)
351. Williamson, Mrs H. S., B.Sc., 3, Verulam Buildings, Gray's Inn, London, W.C. 1. (1921.)
352. Wilson, Mr Malcolm, D.Sc., A.R.C.S., F.L.S., Royal Botanic Garden, Edinburgh. (1921.)
353. Wilson, Miss M. J., B.Sc., 23, Hoseside Road, Wallasey, Cheshire. (1927.)
354. Wiltshire, Mr S. P., M.A., Imperial Bureau of Mycology, 17, Kew Green, Kew, Surrey. (1920.)
355. Wiltshire, Mrs S. P., 24, Lawn Crescent, Kew Gardens, Surrey. (1925.)
356. Winsor, Mr A. P., A.R.C.Sc.I., Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W. 1. (1923.)
357. Wisconsin, The Library, University of, Madison, Wis., U.S.A. (1923.)
358. Wolf, Mr B. L., N.D.A., 55, Catharine Street, Salisbury. (1923.)
359. Woodcock, Mr A. J. A., M.Sc., F.E.S., Clifton Manor, York. (1926.)
360. Woodward, Mr R. C., Ph.D., School of Rural Economy, Oxford. (1924.)
361. Woolhope, The Naturalists' Field Club, Hereford, c/o Col. M. J. G. Scobie, 2, Offa Street, Hereford. (1896.)
362. Worcestershire Naturalists' Field Club, c/o Mr W. J. Else, Victoria Institute, Worcester. (1921.)
363. Wormald, Mr H., D.Sc., A.R.C.S., Research Station, East Malling, Kent. (1921.)
364. Wright, Mr E. Barton, B.Sc., Oakleigh, Godstone, Surrey. (1926.)

RULES.

Society's name and objects.

1. The Society shall be called "The British Mycological Society," and its objects shall be the study of Mycology in all its branches.

Members of Society.

2. The Society shall consist of Honorary Members, Foundation Members and Ordinary Members; the number of Honorary Members shall be limited to 20, and that of Foundation Members to 100*, but the number of Ordinary Members shall be unlimited.

Honorary Members.

3. Honorary Members shall be persons of pre-eminence in Mycology, or who have rendered special service to the Society.

Foundation Members.

4. Foundation Members shall be those Members or Societies who joined the Society previous to the limit of 100 Members having been attained*.

Officers.

5. The Officers of the society shall consist of a President, one or more Vice-Presidents, Treasurer, Secretaries, and Editor or Editors. They shall be elected annually at the Annual General Meeting of the Society.

Government of Society.

6. The government of the Society shall be vested in a Council, which shall consist of the President and other Officers for the time being, together with two or more other Members who shall be elected annually at the General Meeting, and one-half of whom shall retire each year and not be eligible for immediate re-election. The Members to retire shall be those who have been longest in office or, in case of equality, shall be determined by ballot. Ex-Presidents are *ex officio* Members of the Council.

Every Meeting of the Council shall be duly summoned by the Hon. Secretary by at least seven days' notice in writing to each Member of the Council.

* The limit of 100 Foundation Members was reached 22nd Oct. 1903.

Period of Office.

7. The Officers and Council shall hold office as from the 1st of January following their election.

Election of Members.

8. Honorary Members shall only be elected at a Meeting of the Society by a majority of the Members then present.

All Ordinary Members shall be proposed and seconded respectively by existing Members, who shall sign a certificate (see appendix) of recommendation, one at least of the proposers so certifying from personal knowledge. Every candidate for election shall sign an undertaking to abide by the Rules if elected (see appendix). They shall be elected by a majority of the Members present at any meeting of the Society or by the President and Officers of the Society.

Subscription.

9. All Ordinary Members and Societies shall pay an annual subscription of one pound, and Foundation Members five shillings, due on the 1st of January in each year. Honorary Members shall be exempt from any annual subscription.

Any Member wishing to retire from the Society shall give notice to the Hon. Secretary or Treasurer in writing before the 1st of December of the previous Year.

Meetings.

10. The Society shall hold one or more Meetings annually, at a place and time determined by the Members at the preceding Annual General Meeting, or by the Council. The Annual General Meeting for the election of Officers and the transaction of other business shall coincide with the Autumn Foray.

Accounts.

11. At the Annual General Meeting of the Society in each year the Hon. Treasurer shall present duly audited accounts.

Alteration of Rules.

12. The Rules shall not be altered except by a two-thirds majority of the Members present at an Annual General Meeting. A printed copy shall be sent to every Member of the Society on election, and in the event of alteration to all Members.

APPENDIX.

Form of proposal for Ordinary Membership of the British Mycological Society.

.....

of .....

.....

being desirous of becoming an Ordinary Member of the British Mycological Society, we, the undersigned Members of the Society, certify that we consider h to be a desirable Member of the Society, and beg to recommend h for election.

Dated this day of 19

.....(From personal knowledge).

Certificate to be signed by the Candidate.

I hereby certify that I desire to become an Ordinary Member of the British Mycological Society and that I will abide by the Rules if elected.

.....

INDEX

New species are indicated by an asterisk

Abies balsamea, 147
  grandis, 147
  nobilis, 147
  pectinata, 147
Acarospora veronensis Massal., 88
Acer, 148
Acremoniella atra Sacc., 162
  occulta Ashby, 155, 156, 161, 162, Pl. xv, fig. 4.
  occulta Cav., 152, 155, 163, Pl. xv, fig. 7.
Aecidium Caladii Schw., 115
  importatum P. Henn., 114, 115
Agaricus auricula Pers., 218
Aleuria repanda Pers., 166 with 4 text-figs.
Alnus glutinosa, 148
Androsaceus Hudsonii (Pers.) Pat., 79
Anellaria fimiputris (Bull.) Karst., 209
Anemone nemorosa, 115
Apple "Bud-rot" of, 171
  "Eye-rot," 97
  "mummied," 5
  pulp refuse, 214, 294
Armillaria mellea (Vahl) Fr., 1
  mucida (Schrad.) Fr., 209
Arundel foray, 1
Arundo conspicua, 155, 162
  Phragmites, 155
Ash, 2, 118, 119
Ashby, S. F., "*Macrophomina Phaseoli* (Maulb.) comb. nov. The pycnidial stage of *Rhizoctonia bataticola* (Taub.) Butl.," 141
Asparagus, 118
Aspergilli, The, by Charles Thom and M. B. Church, Review of, 75
Asterostromella von Hoehn. & Litsch., 206, 224
  ochroleuca Bourd. & Galz., 224
Astrosporina umbrina (Bres.) Rea, 211
Auricularia auricula-Judae (Linn.) Schroet., 229
  lactea Quél., 229

Bacterium Delphinii, 1
Banana, 155–158
Basidiomycetae, Appendix to British, 205
Basisporium Moll., 163
  gallarum Dale, 165, Pl. xv, fig. 2
  gallarum Durrell, 154
  gallarum Moll., 152, 153, 155–159, 161, 163, Pl. xv, fig. 1
  gallarum Peyr., 155, 162
Batworth Park Plantation, 2
Beet, Spinach, 1
Betula alba, 148
Biatorella albo-cincta A.L.Sm., 88
  pruinosa Mudd, 88
Bilimbia caradocensis A.L.Sm., 87
  lubens A.L.Sm., 89
  Nitschkeana Lahm., 89
  *sublubens Pauls., 88
Boletaceae, 76
Boletus nigrescens Roze & Rich., 80
  purpureus Fr., 220
  rhodoxanthus (Krombh.) Kallenb., 220
  sanguineus Krombh., 220
Botryodiplodia Theobromae Pat., 144
Botryotrichum Lachnella Sacc., 46
  piluliferum Marchal, 46
Botrytis, 6
Bourdotia Eyrei Wakef., 1
Buddin, W., and Wakefield, E. M., "Studies on *Rhizoctonia Crocorum* (Pers.) DC. and *Helicobasidium purpureum* (Tul.) Pat.," 116, Pls. xi–xiv

Cabbage, 1
Cacao, 146
Callitriche stagnalis, 283–286
Calluna vulgaris, 148
Calyptella episphaeria (Mart.) Quél., 225
Carex, 217
Carrot, 117, 118
Cerastium arcticum, 114
Cercospora Rubi Sacc., 2
Cheilymenia dalmeniensis (Cke.) Boud., 79
Cinnamomum ovalifolium, 50
Citrus, 146
Cladium Mariscus, 217
Clavaria amethystina (Batt.) Fr., 80
  gigaspora Cotton, 80
  Greletii Boud., 226
  Krombholzii Fr., 80
  Kunzei Fr., 80
  luticola (Lasch) Fr., 226
  pallida (Schaeff.) Bres., 225
  tenuipes, B. & Br., 80
  truncata Quél., 226
Clitocybe conglobata (Vitt.) Bres., 214
  ectypa Fr., 215
  fritilliformis (Lasch) Fr., 214
  infumata Bres., 215
  *pseudoconglobata Rea, 213
  vibecina Fr., 214

Clover, Red, 118, Pl. XIII, fig. 32
Cnicus palustris, 113
Coconut, 155–157
Coffee, 146
Collema cataclystum Koerb., 88
Collybia infumata (Bres.) Rea, 215
  leucomyosotis Cke. & Sm., 1
Coniosporium, 160
  extremorum Syd., 155, 161, 163
  Gečevi Bubák, 152, 154, 158–163, Pl. XV, fig. 5
  Gečevi Sacc., 154, 160
  micans Gaja, 155, 159, 162
  oryzinum Sacc., 160
Cook, W. R. Ivimey, "The influence of environment on the infection by *Ligniera Junci*," 282
Coprinus Boudieri Quél., 219
Corchorus capsularis, 141
  olitorius, 141
Corticium atrovirens Fr., 80
  bisporum Bourd. & Galz., 224
  byssinum (Karst.) Massee, 79, 224
  diademiferum Bourd. & Galz., 225
  fastidiosum (Fr.) Bourd. & Galz., 80
  Solani (Pril. & Delac.) Bourd. & Galz., 141
  tulasnelloideum von Hoehn. & Litsch., 222
Cortinarius epipolius Fr., 209
  *intermedius Rea, 209
  orellanus Fr., 209
  purpurascens Fr., 79
  Queletii Bataille, 209
Corylus Avellana, 148
Cotton, 141
Council—Knight, H. H., 79
  Mason, E. W., 79
Cowpeas, 141
Crataegus Oxyacantha, 148
Craterellus *amethysteus Rea, 220
  pistillaris (Schaeff.) Fr., 226
Ctenomyces serratus Eidam, 80
Cullenia excelsa, 50
Cunningham, G. H., "The development of *Geaster velutinus*," 12, with 9 text-figs.
Currant, 27, 29
Cylindrocarpon janthothele Wr., 27
  Mali (Allesch.) Wollenw., 6, 8
Cyphelium inquinans Trev., 87
Cytospora, 6

Daldinia concentrica, 2
Darbishire, O. V., "The soredia of *Peltigera erumpens* Wain. and *P. scutata* Kbr.," 52, Pls. IX, X
Deighton, F. C., "On the occurrence of *Diaporthe perniciosa* or a closely related form on Lilac," 70
Dematium ramorum Schw., 105
Diaporthe Asparagi Fuck., 118
  perniciosa March., 6, 26, 70–73
Diderma floriforme Pers., 86
Didymella applanata Sacc., 21
Digitalis purpurea, 121
Dinmore Hill, 79, 86–88
Diplodina laurina Sacc., 2
Dothidea ribesia (Pers.) Fr., 28
Dothiorella Cajani Syd. & Butl., 145

Eichleriella spinulosa (Berk. & Curt.) Burt, 1, 79
Elliott, J. S. Bayliss, D.Sc. "*Aleuria repanda* Pers.," 166, with 4 text-figs.
  "Studies in Discomycetes IV," 290
Entoloma majale Fr., 212
Epicoccum hyalopes Miyake, 152, 155, 160, 163, Pl. XV, fig. 6
  levisporum Pat., 155, 161
  neglectum Desm., 160
Eriochloa subglabra, 161

Fagus sylvatica, 148
Femsjonia luteoalba Fr., 79
Ficus elastica, 163
Flammula austera Fr., 215
  carbonaria Fr., 212
  fusus (Batsch) Fr., 215
  inopus Fr., 215
  inopus Rea, 213
Fomes annosus Fr., 147, 148
  pinicola (Swartz) Fr., 221
Foray—Arundel, 1
  Hereford, 79
Fraxinus excelsior, 148
Fuligo muscorum Alb. & Schw., 86
Fusarium, 5, 6, 21, 22, 26, 171
  Blackmanii Brown & Horne, 171
  Cydoniarum Roum., 172
  fructigenum Fr., 171
  gemmiperda Aderh., 171
  Wilkommii Lindau, 6, 12

Ganoderma applanatum (Pers.) Pat., 1
  lucidum (Leyss.) Karst., 80
  resinaceum Boud., 79
Geaster marginatus Vitt., 207
  minimus Schw., 207
  nanus Pers., 207
  Schmidelii Vitt., 207
  velutinus Morg., 12–20, text-figs. 1–9
Gibberella cyanogena (Desm.) Sacc., 1
Glenospora, 105, 107, 113
  Curtisii Berk. & Desm., 105–113
  elastica Koorders, 163, Pl. XV, fig. 9
  melioloides B. & C., 110
  ramorum (Schw.) B. & Br., 105–113
  Sacchari Speg., 155, 166, 162, 163
  Thwaitesii Berk. & Desm., 107

Gloeocystidium croceotingens Bres., 1
Gloeosporium maculicola Allesch., 1
Tiliae Oud., 1
Gloeotulasnella von Hoehn. & Litsch., 206, 230
cystidiophora von Hoehn. & Litsch., 230
Glyceria maritima, 115
Gnomonia veneta (Sacc. & Speg.) Klebh., 1
Groundnuts, 141
Gynerium, 155, 159, 162

Hadrotrichum arundinaceum Cke. & Mass., 155, 162, 163
Phragmitis Fuck., 162
Haugh Wood, 80
Hebeloma anthracophilum Maire, 212
Helicobasidium Peckii Burt, 122
purpureum (Tul.) Pat., 116–138, Pls. XI, figs. 1–8, 14; XII, figs. 13–30; XIII, fig. 32; XIV, figs. 35–37
Helotium lenticulare Fr., 294
Hereford foray, 79, with group
Heterochaetella crystallina Bourd., 2
Hevea, 146
Hoggan, T. A., M.Sc., "The parasitism of *Plowrightia ribesia* on the currant," 27–43, Pls. IV–VII, and 2 text-figs.
Howard, H. J. Review of "A Monograph of the Mycetozoa" by A. Lister, 3rd edition revised by Gulielma Lister, 74
Hyalina incarnata (Cke.) Boud., 294
Hydnum pteruloides (Mont.) Pat., 279
Hygrophorus calyptraeformis Berk., 80
intermedius Pass., 80
*lepidopus Rea, 80, 214
Reai Maire, 80
Hymenochaete ramealis Berk., 276–279, 281
tenuissima Berk., 281
Hypholoma catarium Fr., 213
epixanthum Rick., 213
radicosum Lange, 213
Hypochnus phylacteris (Bull.) Rea, 222
purpureus Tul., 122
tulasnelloideum (von Hoehn. & Litsch.) Rea, 222
violaceus Ericks., 117
Hypocrea fungicola Karst., 1
gelatinosa (Tode) Fr., 80
Hypoxylon argillaceum (Pers.) Berk., 79

Inocybe conformata Karst., 79
corydalina Quél., 79
fastigiata (Schaeff.) Rick., 210
lacera Fr., 210
*pseudofastigiata Rea, 210
pyriodora (Pers.) Fr., 79
relicina Fr., 210
umbrina Bres., 211
Iris Pseudacorus, 286
Isidia, 67

Juniperus bermudianus, 48, 50
communis, 147
Jute, 141

Knight, H. H., M.A., Review of "A Monograph of Lichens found in Britain," Part II, 2nd edition revised by A. Lorrain Smith, F.L.S., 74
Kuehneola albida Magnus, 80

Lachnocladium rameale B. & Br., 112, 276–279
Lactarius controversus (Pers.) Fr., 80
resimus Fr., 219
vellereus Fr., 80
Larix europaea, 147
leptolepis, 147
Larkspurs, 1
Laurus nobilis, 2
Lecidea goniophila Schaer., 88
latypea Ach., 88
Lenzites albida Fr., 221
Lepiota aspera (Pers.) Quél., 208
echinella Quél. & Bern., 208
Pauletii Fr., 208
Leptogium cataclystum Nyl., 88
Leptopodia ephippium (Lév.) Boud., 79, 80
Leptosphaeria Asparagi Fuck., 118
circinans (Fuck.) Sacc., 117, 118
Leucogaster (Hesse) Zeller & Dodge, 205, 206
floccosus Hesse, 205, 207
Lichens, "A Monograph of, found in Britain, Part II, 2nd edition revised," Review of, 74
of the Hereford foray, 87
Rate of growth of, 149
Recent Literature, 231
Ligniera Junci (Schwartz) Maire & Tison, 2, 282
Lime, 1
Lipara lucens, 153
Lister, Gulielma, F.L.S., "Mycetozoa gathered during the Hereford foray," 86
Lucerne, 117
Lycogala conicum Pers., 86
epidendrum (Linn.) Pers., 86

Macrophoma Cajani Syd. & Butl., 143, 145
Corchori Saw., 141, 143, 145
Phaseoli Maubl., 143–145
pinea (Desm.) Pat. & Syd., 144
Sesami Saw., 143, 145
Macrophomina, 144
Phaseoli (Maubl.) Ashby, 141–146
philippinensis Petr., 143, 145
Maize, 152, 154, 157–160
Marasmius gelidus Quél., 220
Mason, E. W., M.A., M.Sc., "On species of the genus *Nigrospora* Zimmerm. recorded on Monocotyledons," 152–163, Pl. XV
Medlar, 2
Melampsorella Caryophyllacearum Schroet., 114
Melanconium, 160
Melanospora pampeana Speg., 158
Members, List of, 298
Memnonium Cda., 157
palmicolum Cke., 155, 157, 163
Mentha Pulegium, 286
Mercurialis perennis, 119, 120, Pl. XIV, figs. 33, 34
Microcera coccophila Desm., 51
Moccas Old Park, 80, 86, 87
Monilia fructigena Pers., 6
Monotospora nigra Morg., 154, 158, 159, 163
Oryzae B. & Br., 152, 154, 160, 163
toruloides Cda., 160
Mycena lasiosperma Bres., 216
*trachyspora Rea, 216
Mycetozoa, "A monograph of, by Arthur Lister. 3rd edition, revised by Gulielma Lister," Review of, 74
gathered during the Hereford foray, 86
Mycogone nigra (Morg.) Jens., 154, 158, 160, 163
Mycology and plant pathology, 91
Myriangium, 106, 110, 111
Curtisii Berk., 110

Napicladium arundinaceum (Cda.) Sacc., 162
Narcissus bulbs, 80
Natrass, R. M., "Notes on *Nectria Rubi*," 23
Nectria cinnabarina (Tode) Fr., 29
galligena Bres., 5–12, Pls. I–III
mammoidea Phill. & Plowr., 27
Rubi Osterw., 20–27
Rubi Weese, 27
Nigrospora Zimmerm., 152–163
javanica Palm, 154, 155, 159, 162, 163
Oryzae (B. & Br.) Petch., 152, 154, 158
Panici Kuyp., 155
Nigrospora Panici Zimmerm., 155, 156, 159, Pl. XV, fig. 8
Sacchari (Speg.) Mason, 161, 163
sphaerica (Sacc.) Mason, 157, 158, 161–163
Nolanea cetrata (Fr.) Schroet., 217
majalis (Fr.) Konrad, 212, 216

Odontia junquillea Quél., 222
Oedemium ramorum Fr., 106, 108
Oligonema nitens (Lib.) Rost., 86
Omphalia atropuncta (Pers.) Quél., 80
candida Bres., 217
gibba Pat., 217
Ophionectria *coccorum Petch, 48, 52, Pl. VIII, figs. 6–10

Pachyella depressa (Phill.) Boud., 294
*var. pallida Rea, 294
Paine's Wood, 1
Panicum amphibium, 155, 156
barbinode, 161
Papularia Fr., 160
Paulson, Robert, F.L.S., F.R.M.S., "Lichens of the Hereford foray," 87
Pear, Bud-rot of, 171
Eye-rot, 8, 11
Pellagra, 157
Peltandra virginica, 114, 115
Peltigera erumpens Wain., 52–68, Pls. IX, X, figs. 1–11
scutata Kbr., 62–68, Pl. X, figs. 12–14
Penicillium, 6
Peniophora longispora (Pat.) von Hoehn. & Litsch., 1
miniata (Berk.) Burt, 205, 225
Peppers, 146
Petch, T., B.A., B.Sc., *Septobasidium rameale*, 276–281
"Studies in entomogenous fungi, XII. *Pezizotrichum Lachnella*; *Ophionectria coccorum*; *Volutella epicoccum*," 44–51, Pl. VIII
"Studies in entomogenous fungi. XIII. *Glenospora*," 105–112
Pethybridge, G. H., "Mycology and plant pathology," 79, 91–105
"Notes on *Nectria Rubi*," 20–23
Pezizotrichum Lachnella Sacc., 44, 49, 50, Pl. VIII, figs. 1–5
Phaeocyphella episphaeria (Quél.) Rea, 225
Phaseolus vulgaris, 143
Phomopsis Sophorae (Trav.) Grove, 1
Phragmites communis, 153, 227
Physcia hispida Tuckerm., 87
Picea excelsa, 147
sitchensis, 147
Pigeon-pea, 143
Pine, 1
cones, 294

Pinus Laricio, 147
monticola, 147
parviflora, 114
Strobus, 147
sylvestris, 147
Pistillina Quél., 206, 227
hyalina Quél., 227
Patouillardii Quél., 227
Plane, 1
Plant pathology, 91, 94
Plantago major, 286
Plasmodiophora Brassicae Woron., 287, 288
Tabaci Jones, 288
Platygloea Peniophorae Bourd. & Galz., 228
vestita Bourd. & Galz., 229
Plectodiscella veneta Burk., 20
Pleurotus geogenius (DC.) Fr., 218
revolutus Kickx, 218
Plowrightia ribesia (Pers.) Sacc., 27
Pluteus Bullii Berk., 208
cervinus (Schaeff.) Fr., 208
*luteovirens Rea, 208
Poa annua, 286
Podosphaera leucotricha (Ell. & Ev.) Salm., 173–202
Polyporus amorphus Fr., 221
betulinus (Bull.) Fr., 1
lacteus Fr., 221
Poria eupora Karst., 80
purpurea Fr., 80
xantha (Fr.) Lind, 221
Porter, L., M.Sc., "Rate of growth of Lichens," 149
Potato, sweet, 141, 146
tuber rot, 80
Presidents: E. J. Butler, C.I.E., D.Sc., 79
Proceedings, 77
Prunus avium, 148
Padus, 148
Psaliota sylvicola (Vitt.) Fr., 209
Pseudobasidium Tengw., 160
Pseudoperonospora Humuli (Miy. & Tak.) Wilson, 2
Pseudotsuga Douglasii, 147
Puccinia Cnici-oleracei Pers., 114
le Monnieriana Maire, 113
Pyrus Aria, 148
Aucuparia, 148

Quercus Ilex, 148
Robur, 148

Radulum quercinum Fr., 2
Ramsbottom, J., O.B.E., M.A., Reviews of "Die Pilze Mitteleuropas Band I, Die Rohrlinge (Boletaceae)" by F. Kallenbach, 76, 296
"The Microbiology of Cellulose, Hemicelluloses, Pectin and Gums," by A. C. Thaysen & H. J. Bunker, 295
"The Aspergilli," by C. Thom & M. B. Church, 75
"Enzymes: Properties, Distribution, Methods and Applications," by S. A. Waksman & W. C. Davison, 295
Ramularia beticola Fautr. & Lamb. 1
Ranunculus aquatilis, 283–286
circinatus, 283
Ficariae, 115
repens, 115
Raspberry, 20
Rea, Carleton, B.C.L., M.A., "Appendix to British Basidiomycetae," 205
Review of "Iconographia Mycologica," by J. Bresadola, 295
Reviews:
J. Bresadola, "Iconographia Mycologica," 295
F. Kallenbach, "Die Pilze Mitteleuropas. Band I, Die Rohrlinge (Boletaceae)," 76, 296
G. Lister, "A Monograph of the Mycetozoa, 3rd edition," 74
A. Lorrain Smith, "A Monograph of Lichens found in Britain," Part II, 2nd edition, 74
A. C. Thaysen & H. J. Bunker, "The Microbiology of Cellulose, Hemicelluloses, Pectin and Gums," 295
C. Thom & M. B. Church, "The Aspergilli," 75
S. A. Waksman & W. C. Davison, "Enzymes, Properties, Distribution, Methods and Applications," 295
Rewell Wood, 1
Rhacodium ramorum Schw., 106, 108
Rhizoctonia bataticola (Taub.) Butl., 141, 143–145
Crocorum (Pers.) DC., 116–138, Pls. XI, fig. 12, XII, fig. 31, XIII, fig. 32, XIV, figs. 33–35
lamellifera Small, 141, 145
Menthae B. & Br., 137
Solani Kühn, 117, 141
Rhododendron ponticum, 148
Ribes nigrum, 116
Rice, 152, 154, 157, 159–161
Rosellinia mammoidea Cke., 80
necatrix Bert., 80
Rubus, 227
Rules, 314
Russula constans Britz., 218
constans (Karst.) Romell, 218
flava Romell, 218
lilacea Quél., 79
paludosa Britz., 218

Saccoblastia Moell., 206, 228
sebacea Bourd. & Galz., 228
Scirpus, 217
Sclerotinia Mespili Schell., 2
Sclerotium bataticola Taub., 141, 143, 145
Septobasidium, 112, 113
alatum Lloyd, 277, 278
*aligerum Petch, 279–281, Pls. XVIII, figs. 1, 2, XIX, figs. 1, 2
granulosum Syd., 278, Pl. XVIII, fig. 3
pteruloides (Mont.) Pat., 112, 279, 280, Pls. XVIII, figs. 4, 5, XIX, figs. 3–7
rameale, 276–281
rameale (Berk.) Bres., 277–279
rameale (B. & Br.) Bres., 277–279
rameale (B. & Br.) Petch, 277–279
suffultum (B. & Br.) Pat., 47
Sesamum indicum, 142–144
Smith, A. Lorrain, F.L.S., "Recent Lichen Literature," 231
Sophora japonica, 2
Soredia, 67
Sorosphaera Veronicae Schroet., 288, 289
Sparganium, 217
Spergularia marginata, 114
media, 114
rubra, 114
Spongospora subterranea, 288, 289
Sporotrichum Maydis Garov., 154, 157, 160, 163
Stachybotrys Auct., 157
Stemonitis herbatica Peck, 86
Stereum insignitum Quél., 223
rameale (Berk.) Massee, 276, 279
Stypinella Schroet., 122
Sugarcane, 155–157, 161, 162
Symphytum officinale, 217

Tapesia fusca (Pers.) Fuck., 292
lividofusca (Fr.) Rehm, 293
retincola (Rabenh.) Karst., 294
Tea, 146
Thelephora pedicellata Schw., 277
suffulta B. & Br., 276, 277
Thuya gigantea, 147
Tilia cordata, 208
Tomatoes, 159
Tomentella phylacteris (Bull.) Bourd. & Galz., 222
Tomentellina von Hoehn. & Litsch., 205, 223
ferruginosa von Hoehn. & Litsch., 79, 223
Tremella glacialis Bourd. & Galz., 229
Trichia verrucosa Berk., 86
Tricholoma guttatum (Schaeff.) Fr., 211
guttatum (Schaeff.) Quél., 211
guttatum (Schaeff.) Rea, 211
impolitum (Lasch) Fr., 211
resplendens (Fr.) Quél., 211, 212
sulphurescens Bres., 211
turritum Fr., 212
Trichosporium, 157
insigne Mass. & Salm., 162
Maydis (Cattan.) Sacc., 157
Maydis (Garov.) Sacc., 154, 157, 163
palmicolum (Cke.) Sacc., 157, 163
sphaericum Sacc., 154, 158, 162, 163
Trichopeziza caesia (Pers.) Boud., 290, 293
Trollius europaeus, 115, 116
Tsuga albertiana, 147
Tuberculina Sacc., 127–129, 137, 138
maxima Rostr., 129
persicina Ditm., 129
Tubifera ferruginosa Gmel., 86
Tulasnella allantospora Wakef. & Pears., 229
Tulasnella cystidiophora von Hoehn. & Litsch., 1, 230
microspora Wakef. & Pears., 230
violacea (J. Olsen) Juel, 229
violea (Quél.) Bourd. & Galz., 2
Typhula candida Fr., 226

Ulmus montana, 148
Uredineae and Ustilagineae, observations on some Scottish, 113
Uredo Glyceriae Lind, 115
Urocystis anemones (Pers.) Schroet., 115
Uromyces Ari-Virginici Howe, 115
Betae (Pers.) Tul., 1
Caladii Farl., 115
sparsus Lév., 114
Urtica dioica, 121, Pl. XIV, fig. 35
Usnea florida Web., 87
hirta Ach., 87
Ustulina vulgaris Tul., 1

Venturia inaequalis Wint., 6
Veronica Chamaedrys, 288
Verticillium Nees, 20
Vice-President—A. Lorrain Smith, 79
Volutella *epicoccum Petch, 50, Pl. VIII, figs. 11–14

Wakefield, E. M., M.A., F.L.S. "Arundel foray report," 1
"Hereford foray report," 79
Wakefield, E. M., and Buddin, W., "Studies on *Rhizoctonia Crocorum* (Pers.) DC. and *Helicobasidium purpureum* (Tul.) Pat.," 116, Pls. XI–XIV
Waldie, J. S. L., B.Sc., C.D.A., and

Wilson, Malcolm, "Observations on some Scottish Uredineae and Ustilagineae," 113
Weston, W. A. R. Dillon, M.A., "A note on the 'bud-rot' of Apple Trees," 171
"Notes on the canker fungus *Nectria galligena* Bres.," 5, Pls. I–III
Wheat, 153, 155, 159, 162
Wilson, Malcolm, D.Sc., F.R.S.E. F.L.S., "The host plants of *Fomes annosus*," 147
Wilson, Malcolm, D.Sc., F.R.S.E., F.L.S., and Waldie, J. S. L., "Observations on some Scottish Uredineae and Ustilagineae," 113
Woodward, R. C., B.Sc., Ph.D., "Studies on *Podosphaera leucotricha* (Ell. & Ev.) Salm.," 173, Pls. XVI, XVII, and 1 text-fig.
Wormesley, 79, 86, 88

CAMBRIDGE: PRINTED BY
W. LEWIS, M.A.
AT THE UNIVERSITY PRESS